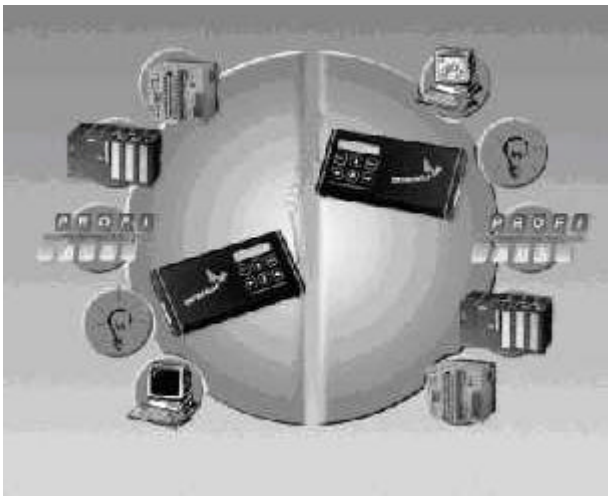
Operating Instructions

DATAEAGLE ® WIRELESS DATA SYSTEM

Wireless Data in Automation Technology



DATAEAGLE DE 1000
DATAEAGLE DE 2000
DATAEAGLE DE 3000
DATAEAGLE DE 4000
DATAEAGLE DE 5000
DATAEAGLE WOPY

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1 Important General Information

1.1 Significance of the Operating Instructions

The operating instructions form an integral part of the DATAEAGLE product and must always be readily available for reference. This applies up to the point where the DATAEAGLE is finally disposed of. The operating instructions are to be included if the DATAEAGLE is sold, transferred, or leased to another party.

1.2 Copyright

These operating instructions are intended only for the operator and associated personnel. Unless otherwise expressly authorized, their contents may not be transferred, duplicated, commercialized, or disclosed in any other way, neither in full nor in part. Schildknecht Industrieelektronik retains all rights to this documentation.

Violations may be subject to prosecution.

1.3 Exclusion of Liability

We have examined the contents of this publication with regard to their agreement with the hardware and software it describes. Nonetheless, discrepancies cannot be entirely ruled out so that we assume no liability for complete correspondence. The information in this publication is reexamined regularly and any required corrections are included in subsequent editions. We welcome your comments and suggestions for improvements.

Schildknecht Industrieelektronik assumes no liability for damages resulting from a lack or insufficient understanding of these operating instructions. We therefore recommend that the operator have all operating personnel confirm their understanding of this material in writing.

For safety reasons, alterations or functional modifications to the DATAEAGLE are prohibited. Therefore, any alterations to the DATAEAGLE not explicitly authorized by the manufacturer will result in the forfeiture of any damage claims against Schildknecht Industrieelektronik. This also applies if non-OEM parts or any components or equipment not approved by us are employed.

1.4 DATAEAGLE Maintenance

The DATAEAGLE itself is maintenance-free. Therefore, no regularly scheduled inspection or maintenance tasks are required during operation.

1.5 Decommissioning and Disposing of the DATAEAGLE

The operator must follow all locally applicable environmental regulations when decommissioning and disposing of the DATAEAGLE.

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1.6 Proper Use

Proper use includes proceeding in accordance with these operating instructions.

The DATAEAGLE wireless data system may only be employed for the applications described in the technical documentation and only in conjunction with the third-party equipment or third-party components we have recommended or approved.

The safe and trouble-free operation of the product presupposes proper shipping, proper storage, setup, and installation as well as careful operation and maintenance.

The 24 V DC nominal operating voltage falls under the category SELV (Safety Extra Low Voltage) and is therefore not subject to the EG low voltage guideline. The use of other power supplies is prohibited. An external mains adapter with an output voltage of 12 V DC is used in conjunction with the combination packet (part no. 10236) for connection to a 230 V AC mains power supply.

1.7 Personnel Qualification

The following tasks on the DATAEAGLE may only be performed by qualified personnel:

- Installation;
- Commissioning;
- Operation;
- Maintenance.

Within the context of safety regulations, qualified personnel are individuals authorized to commission, to ground, and to identify equipment and systems in accordance with the safety-engineering standards.

All operating personnel must be trained accordingly.

Personnel involved with operating the unit in conjunction with controllers must possess sound programming skills for the individual controller and programming language in question.

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1.8 Additional Safety Information

The modules of the DATAEAGLE product line represent the current state-of-the-art and comply with all currently applicable safety regulations and the corresponding, harmonized European standards (EN).

The following apply to users:

- Applicable safety and accident prevention regulations;
- EG guidelines or equivalent local regulations;
- Generally recognized safety-engineering rules.

The following rules must be observed:

- The modules must always be disconnected from the mains power supply (unplug the power cord at the wall outlet) whenever work related to installation or maintenance is to be performed. This will avoid accidents resulting from electrical shock.

- Malfunctions cannot be ruled out should actual values go above or below the indicated tolerances!

- Additional external overload circuits must be provided wherever malfunctions could result in material damage or injuries.

- The products must be installed in such a manner so as to prevent functions from being accidentally activated.

- Connecting lines are to be selected and installed in such a manner that capacitative and inductive emissions do not interfere with the equipment. Line interruptions are to be corrected in such a manner that no undefined conditions can arise.

- Any malfunctions or other damages must be immediately reported to the responsible individual.

- Protective and safety equipment may not be bypassed or bridged. Prior to starting the equipment, any safety equipment which was previously removed must be reinstalled and undergo a functional test.

- The modules must be secured to prevent misuse or accidental use.

- All originally applied information signs, stencils, labels, or similar items must be observed and must be maintained in a legible condition.

- Regulations regarding the reduction of EMC must be strictly observed.

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1.9 EG Guideline EMI 89/336/EWG

The following applies to the DATAEAGLE wireless data system:

Products displaying the CE symbol comply with the requirements of EG Guideline 89/336/EWG “Electromagnetic Compatibility”.

CE The EG conformity declaration and the associated documents are available to the responsible authorities in accordance with the above-cited EG Guideline, Article 10(1), at:

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The following information applies to all devices tested in accordance with EN 50081-2:
This is a Class A device. This device may cause radio interference in domestic environments. In such instances, the operator may demand that appropriate measures be taken and compensation be provided.

1.10 CE Conformity

Interference suppression tested in accordance with EN61000-4-3 and EN61000-4-6, test level III
on 02/23/2000: test report SKNE2S1-00; Spieß Technologiezentrum, Karlsbad
on 07/12/2002: test report prepared by NKL, Wolpertshausen

Radio interference suppression tested in accordance with EN50081-2, limit value class A
on 02/20/2000: test report SKNE2F1-00; Spieß Technologiezentrum, Karlsbad
on 07/12/2002: test report prepared by NKL, Wolpertshausen

We herewith declare compliance with CE conformity.

1.11 Application Areas

Products from the DATAEAGLE line comply with the harmonized European standards (EN) applicable to the associated application area.

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1.12 Improvements to EMC Stability

The DATAEAGLE wireless data units are electronic devices constructed in accordance with the current state-of-the-art. Both the robust mechanical construction as well as the design of the electronic components are intended for industrial applications.

Nonetheless, certain steps vital for trouble-free operation must be taken when the devices are installed in or on other equipment. Failure to initiate these procedures will render the measures taken in the device to achieve a high level of interference and destruction stability totally or partially useless. The overall interference stability for the entire assembly depends to a great extent on the correct installation, the installation location, and the wiring. Prior to commissioning, the controller manufacturer's layout requirements for safe and secure operation must be examined. These requirements should be brought into line with the following recommendations.

We have summarized several basic requirements for you:

- The interference voltages transferred to the device through the supply and signal lines as well as electrostatic discharge voltages transferred to the device through contact are dissipated to the ground point. This ground point should be connected to the PE (Protective Earth) ground connection on the device using a low-ohm lead made of a copper wire that is as short as possible.
- Always use shielded cables for all interface lines as well as power supply lines. This will help reduce the "interference probability" by a factor of as much as 100 compared with unshielded conductors and, if the formation of a loop can also be avoided, by a factor of up to 1,000. The shielding mesh density should be at least 85%. A low impedance connection to the ground point is particularly important in order to prevent the interference currents arising on the cable shielding from themselves becoming a source of interference.
- Make sure bus lines are located at a distance of at least 20cm from energy lines and, if possible, are in separate cable conduits.
- Always connect both ends of the shielding to the EMC ground (generally the PE connection).
- Always connect both ends of all unused leads of a conductor to the PE connections.
- Use metal or metallic connector housings. The cable shield should always be connected to the connector housing.
- Always mount any electronic devices on a galvanized mounting plate in the circuit cabinet. This mounting plate forms the EMC ground (neutral point) and is principally responsible for interference suppression. Only in this way can the interference energy flow directly back to the interference source. Avoid coated surfaces such as anodized or yellow chromatized panels. Because of the high line impedance, HF fields cannot be adequately dissipated through the PE network. The PE network can therefore not be equated with the EMC ground, even though both are directly electrically connected to one another.
- Make all connections to the EMC ground as short and as wide as possible. Make sure all metallic housings have good contact with the galvanized mounting surface.
- Make sure all electronic and electric components which could be sources of HF interference fields have an enclosed metal housing.
- Arrange the ground wires from the individual system components radially with respect to the voltage compensation bus. This will prevent interferences from being generated by looped PE conductors which can act as antennas. Haphazard ground wire connections and wire loops can bridge EMC measures, rendering them ineffective.

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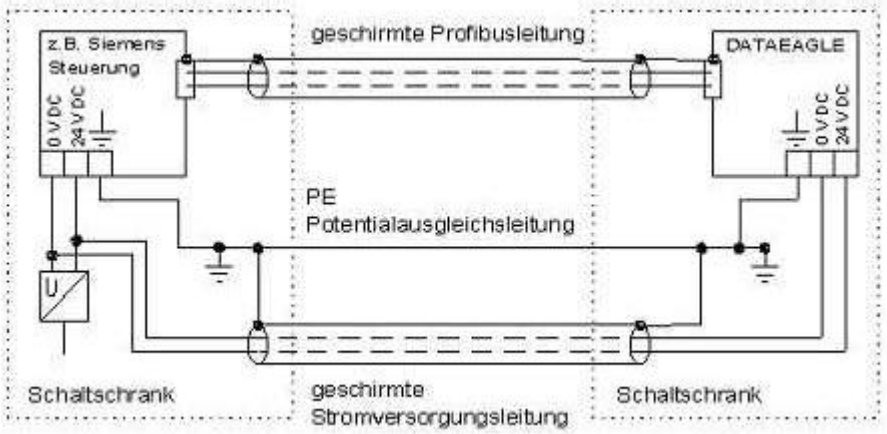
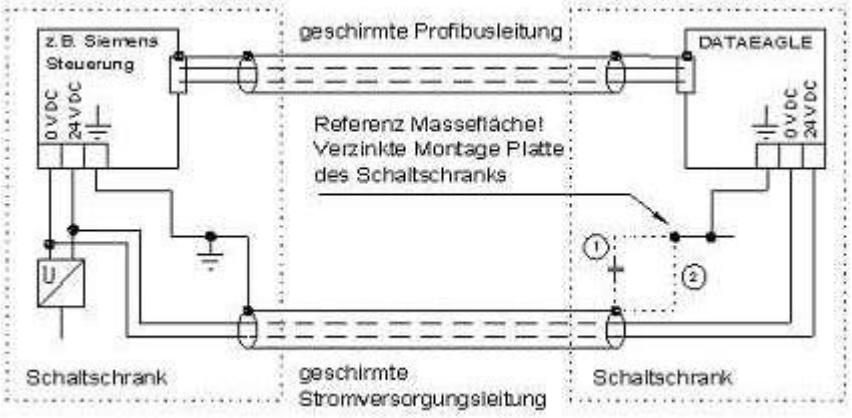
- With regard to the wiring in the circuit cabinet, always make sure that N conductors (neutral conductors) are separated from PE conductors (protective earth). Using a tong-test instrument, measure whether the compensation currents flow across the PE circuit cabinet conductor. There must be no continuous current flow here.



- In environments subject to very high interference levels such as can be found in, for example, industrial areas where induction furnaces are employed, we recommend the PE-free layout (refer to the drawing). Because of the large voltage differences at the various ground points within the facility, the galvanized mounting panel cannot be grounded. Because the DATAEAGLE is only supplied with 24V DC voltage, grounding is not mandatory. If a direct ground connection (2) results in a ring current flowing through the shielding (to be measured with a tong-test instrument), a galvanic separation should be established using a 100nF /230V X capacitor. The capacitor reacts in a low-ohm manner with regard to high frequency interference peaks, but nonetheless prevents ring currents.

  Attention!: For this layout, the mounting plate must not be grounded through the PE conductor.



Ground surface area layout where there is high PE conductor interference.

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2 Brief Overview of the DATAEAGLE Family

DATAEAGLE® is the family name of a wireless data transmission system from Schildknecht Industrieelektronik Systeme, 74372 Sersheim, Germany. This is a modular system in which a wide variety of hardware interfaces as well as wireless technologies can be employed and, to some extent, combined.

The 1st identifier describes the device family.

DE 1xxx	Serial wireless interface
DE 2xxx	Wireless controller connection
DE 3xxx	Wireless Profibus connection
DE 4xxx	Wireless industrial WLAN Ethernet connection
DE 5xxx	Wireless MPI wireless operator panel connection

The 2nd identifier describes the transmission technology employed, generally wireless.

x0xx	ISM 2.4GHz	Available
x1xx	DECT 1.9GHz	Available
x3xx	ISM 869 MHz	Available
x4xx	Timeslot technology, 448MHz	Available
x5xx	GSM cellular phone	Available
x6xx	Conventional telephone network	Available
x7xx	Bluetooth	In development
x9xx	Wampfler Inductive Data Transmission	Available

Our standard wireless system is 2.4GHz.

The 3rd and 4th identifiers define specific hardware or software versions.

DE3000, DE3001	Profibus point-to-point or network
DE2600, DE2610, DE2620	Leased line, party line, or dialup modem
DE 2400, DE 2410	448Mhz / 459 MHZ transmitter

This modular concept allows the wireless transmission medium to be replaced or exchanged as desired. As the user, the advantage to you lies in the fact that the controller interface is independent of the wireless transmission method and therefore also independent of the range and transmission path. A DE 2000 with a 2.4GHz transmitter and a range of 500m behaves in the exact same way as a DE 2400 utilizing timeslot technology and a 15km transmission path.

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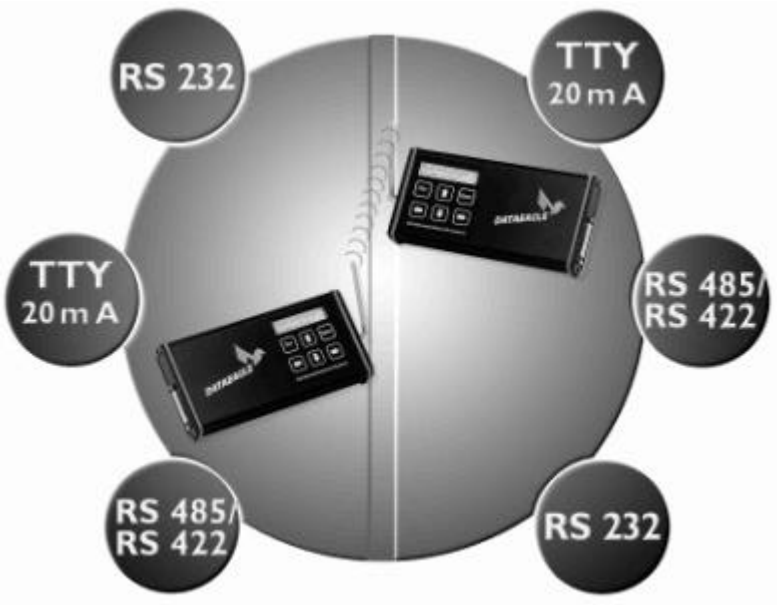
2.1 The DE 1000 Family, “Virtual Cable”



DE 1000 was developed as a replacement for a serial cable, to transmit data to a serial interface via wireless transmission. RS232, 20mA, and RS422/485 interfaces were implemented. The DE 1000 system cannot be used to operate bus systems such as Profibus, CAN, or Interbus

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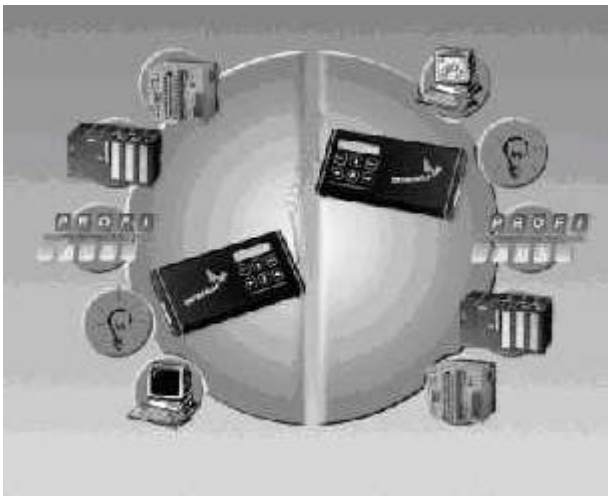
2.2 The DE 2000 Family, “Linking Controllers via Wireless Transmission”



We developed the DE 2000 series of devices for more complex tasks involving hardware and software protocols at the interface. Using these protocols and any additional field bus interfaces which may be required, links can be established to a Profibus DP, SIEMENS S7 300/400 MPI, Siemens S7 200 PPI, or input/output assemblies. The DE 2000 accesses the software drivers already installed in the controllers and components.

For example, the DE 2000 series allows SIEMENS S5 and S7 controllers to be directly linked together. In this case, the DATAEAGLE assumes responsibility for reading the data from the controller and transmitting them to the partner wireless transmission module. The latter then independently writes the data to the second controller. This transmission operates bidirectionally.

Digital and analog input and output modules can also be connected to the wireless modems. This allows these physical signals to be transmitted by wireless methods to make them available at the partner device. The integrated DATAEAGLE concept also allows DATAEAGLE to be combined with various device interfaces. Inputs and outputs can be directly coupled to S5 and S7, an S5 can be connected to an S7 via wireless transmission, or a PC with a 3964R software interface can access an S7.

The modular replacement of the wireless transmission modules also allows greater distances to be bridged. As an example, we would mention the DE 2100 which transmits in the european licencefreee DECT band at 1.9GHz. The DE 2500/2600 represents another special case. Here, the telephone network, leased line or GSM cellular phone network are used as the transmission medium. The connections via interfaces to the controllers remain unchanged, even when the transmission medium changes.

The interfaces to the controllers are completely decoupled from the wireless transmission path and are reactionless. A failure in the wireless transmission path will not affect the protocol interface. This concept has proven itself to be very robust and practical in everyday applications.

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2.3 DATAEAGLE WOPY – Wireless Operator Panel

We have installed the electronics and wireless technology of our DATAEAGLE in a special housing and given it the designation WOPY ®. Together with a battery pack, a charging circuit, a built-in antenna, and a larger keyboard, this represents an efficient operator and monitoring device. The WOPY is available with two different displays: 2 x 16 characters and 8 x 16 characters.

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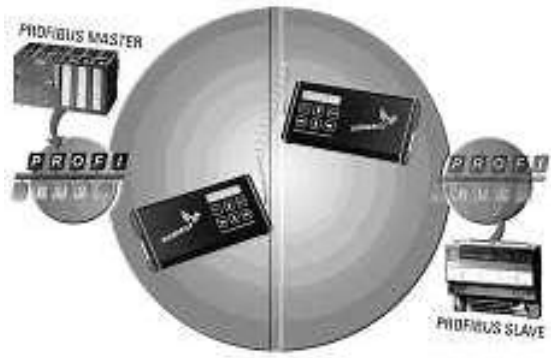
2.4 The DE 3000 Family, “Profibus Via Wireless Transmission”



Using the DE 3000 series, any desired number of Profibus standard slaves can be connected via wireless transmission to a Profibus master.

Depending on the technical application involved, the DE 3000 or DE 3001 can be employed. The differences are outlined in the functional description (refer to Section 3.4).

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2.5 The DE 4000 Family, “Wireless Ethernet”

The DE 4000 series offers you a wireless Ethernet data transmission system suitable for industrial applications. Transmission across the Ethernet is TCP/IP transparent. The DE 4000 is not bound to a PC environment (such as PCMCIA or PCI plug-in boards), but instead has a 10/100BaseT Ethernet interface before and after the transmission path. Depending on the requirements, a DE4000, DE4001, DE4002, DE4003 can be used. The differences is whether several mobile points are to be connected to one access point or whether there are several IP addresses available after the transmission path. The DE 4000 is compatible with WLAN 802.11b and can also be supplemented by Office components.

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2.6 The DE 5000 Family, “OP to S7 MPI Interface via Wireless Transmission”

The DE 5000 transmits the Siemens S7 MPI interface transparently. Applications include, for example, the wireless linking of an operator panel or programming device to the S7 PLC. No network is possible with the DE 5000, instead, a point-to-point connection is always established. Only an MPI subscriber can be connected after the transmission path. The difference with regard to our DE2000 with MPI lies in the fact that, with the DE2000 the MPI interface is only used for reading and writing but this protocol is not transmitted across the wireless transmission path. The DE 5000 on the other hand transmits the MPI protocol with complete transparency across the wireless transmission path. Using a special procedure, we can also combine the MPI interface – which is operated at 187.5 KB – with very slow wireless transmission media. The DE 5500 which permits a transparent link via GSM cellular phone transmission, as well as a DE 5100 with DECT 250mW transmitter are all available.

With the DATAEAGLE WOPY series we have also included a combination of DATAEAGLE and OP in our product line. In this case, an operator device has been equipped with a wireless transmission interface.

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2.7 Device Versions

The following functions are available in devices in the DE 1000 series:
- Transparent transmission with RS232, RS422, RS485, 20mA 1200 – 115200 Baud
- Linking programming devices to SIEMENS S5
- Linking programming devices to SIEMENS S7

The following functions are available in devices in the DE 2000 series:
- Digital inputs and outputs + analog inputs and outputs
- SIEMENS S7 300/400 MPI field bus module
- Siemens S7 200 PPI 187.5 KB
- SIEMENS S5 L1
- 3964 R protocol
- 1 digital input and output directly on the device

The following functions are available in devices in the DE 2001 series:
- DE 2000 with the additional programming capability of the DE 5000

The following functions are available in devices in the DE 2100 series:
- Linking controllers via the license-free 250mW DECT band

The following functions are available in devices in the DE 2300 series:
- Linking controllers via the license-free 500mW 869 MHz band

The following functions are available in devices in the DE 2400 series:
- Use of 448MHz HF modules with timeslot technology and 2 Watts of transmitting power

The following functions are available in devices in the DE 2410 series:
- Use of 459MHz HF modules with up to 2 Watts of transmitting power

The following functions are available in devices in the DE 2500 series:
- Linking controllers via GSM cellular phone technology

The following functions are available in devices in the DE 2600 series:
- Linking controllers via fixed line telephone network

The following functions are available in devices in the DE 26 10 series:
- An ISDN telephone line is used as the link between DATAEAGLE units.

The following functions are available in devices in the DE 2620 series:
- A leased line is used as the link between DATAEAGLE units.

The following functions are available in devices in the DE 2630 series:
- A 2-wire party line is used as the link between DATAEAGLE units, that is, several receivers can be connected.

The following functions are available in devices in the DE 3000 series:
- Profibus DP link for a remote Profibus standard slave (full bus speed)

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The following functions are available in devices in the DE 3001 series:
- Profibus DP link for several remote Profibus standard slaves with up to 93.75 KB

The following functions are available in devices in the DE 3100 series:
- Profibus DP link for a remote Profibus standard slave (full bus speed); transmission medium: DECT

The following functions are available in devices in the DE 3101 series:
Profibus DP link for several remote Profibus standard slaves with up to 93.75 KB; transmission medium: DECT

The following functions are available in devices in the DE 3610 series:
- Profibus DP link for a remote Profibus standard slave (full bus speed) via a leased line

The following functions are available in devices in the DE 4000 series:
- Ethernet link to a TCP/IP client

The following functions are available in devices in the DE 4003 series:
- Ethernet link to several TCP/IP clients (Bridge)

The following functions are available in devices in the DE 5000 series:
- Transparent MPI link on the 2.4GHz band

The following functions are available in devices in the DE 5100 series:
- Transparent MPI link on the DECT band

The following functions are available in devices in the DE 5500 series:
- Transparent MPI link via a GSM cellular phone connection

The following functions are available in devices in the DE 5600 series:
- Transparent MPI link via a fixed line telephone network

Accessory equipment and price options are required for some of the above functions.

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3 Functional Description

The following chapter contains a detailed description of the technical function.

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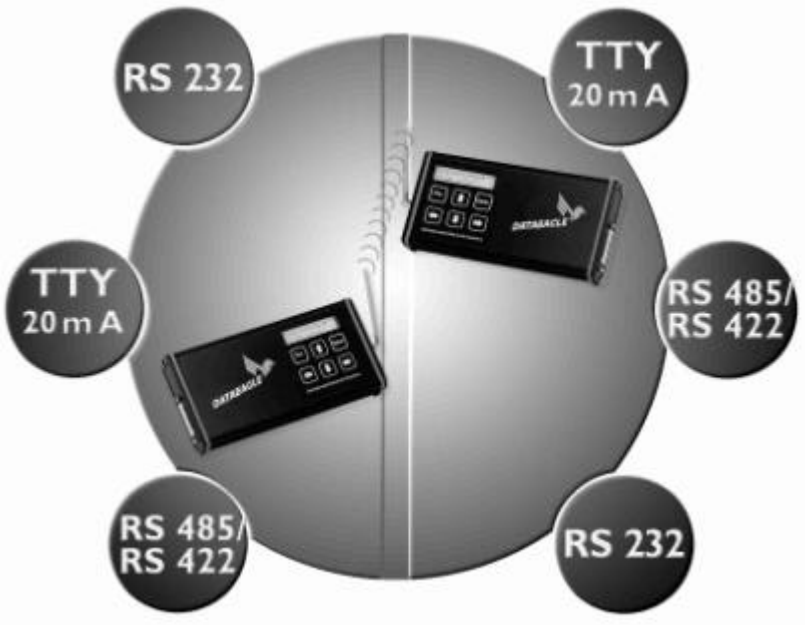
3.1 DE 1000 “Virtual Cable”



DATAEAGLE® DE 1000 is a universal wireless mode which, thanks to the transparent transmission, can be operated at all serial interfaces that meets the following requirements: RS232, RS485/RS422, or TTY interfaces with baud rates of 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200; 8 data bits with E or O or N parity. From the interface perspective, data transmission is transparent, however, on the wireless side, an extensive transmission and data backup process provides data transmission that is as fault-insensitive as possible. As a rule, however, higher-level software telegrams for transmission monitoring and control to the connected devices must be used here.

The DE 1000 comes equipped with an RS232 and TTY (20mA) interface. Optionally, an electrically isolated RS485/422 interface is also available. The own and the partner wireless address must be set in the DE 1000. While these are freely selectable, they must be different. The device address only becomes important once several systems are installed in the same wireless cell in order to be able to operate multiple transmission paths in parallel. Network operation is possible if the wireless master is set for a broadcast address of 00.

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3.1.1 DE 1000 Applications

One possible application for the DE 1000 series is connection to SIEMENS S5 and S7 PLC controllers. Based on requests from numerous customers we have designed the DATAEAGLE to link the programming device (PG) and the controller (AG) via the programming device interface. Due to the particularly restrictive behavior of the automation device, special demands are placed on the wireless transmission path in this case. With the DATAEAGLE, the programming device can use wireless transmission building blocks to read and write to the PLC from a distance as well as call up status information concerning, for example, control/status variable in real time. No special software is required. You can continue to work with your accustomed programming software SIEMENS© Step5 and Step7, AC-CON© DELTALOGIC, S5 for WINDOWS, IBH©, or others. For programming, only the Siemens MPI-COM converter is required and is installed after the transmission path, between the S7 and DE,

Of particular interest is employment for programming, service, and commissioning in those situations where it is impossible to lay a cable across the factory floor, up or down several stories, or even across roads. In the case of data transmission to moving objects, this eliminates the need for slip rings, infrared data light barriers, data waveguides, and trailing cables. DATAEAGLE has been successfully employed in mining operations to control giant conveyors or in cranes and driverless transport systems.

DATAEAGLE also offers a practical and cost-saving link for occasionally monitoring the controller.

3.1.2 DE 1000 Product Limits

The DE 1000 system is not suitable for direct connection to bus systems such as PROFIBUS DP, CAN Bus, or INTERBUS and SIEMENS S7 MPI Bus. A special hardware and software interface must be used for each of these instances. Refer to
DE 2000/3000/5000

3.1.3 DE 1000 Family Settings

3.1.3.1 Transparent

Only the transparent driver can be activated in the "**Interface Drivers**" menu of the DE 1000.

Virtual cable function. Characters at the serial interface are transmitted 1:1 by wireless transmission and are output on the partner device's interface. Choose this operating mode if you want the functions of a virtual cable. The parameters for the serial interface such as baud rate, stop bits, as well as priority can be set under "USER". We have provided so-called "profiles" for several of the most frequently used links. The correct interface parameter settings are already defined in these profiles:
AS511 via S5 PG interface;
SINEC L1 via S5 PG interface;
S7-300 MPI smart cable;
S7-200 PPI adapter.

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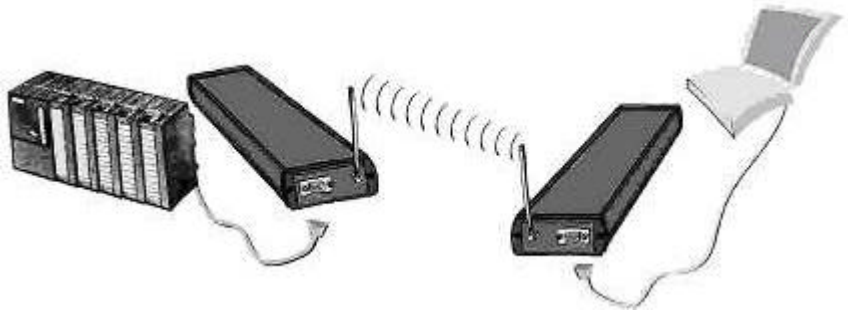
3.1.3.2 DE 1000 to Program SIEMENS S5 and S7 PLCs

The standard delivery of the DE 1000 combination packet includes an S5 cable set for the automation device and COM ports. The DE 1000 combination comes in a hard shell case.
The 6ES7 901-3BF00-xxxx PPI cable is required for links to S7 200, while the 6ES7972-0CA21-0XA0 MPI cable is required for SIEMENS S7 300 and 400. These MPI and PPI adapters are also required to directly connect a PC to the automation device and, as a rule, are available.

The system is designed to alternately work with S5 and S7.

Time-critical protocols such as Siemens S5 PG (AS511) protocols require a minimum quality of 70%.



3.1.3.3 DE 1000 as a Virtual Cable

DATAEAGLE DE 1000 can be used for the transmission of asynchronous serial interfaces with baud rates between 1200 and 115200 baud in the full duplex mode.
All the necessary parameters can be defined under the Interface Drivers / Transparent / USER menu item.

3.1.3.4 Interface Settings

The transmission parameters are defined in the DATAEAGLE menu. Using the right arrow, a password prompt appears which, once successfully answered, opens the transparent interface driver menu.
(Refer to general commissioning / menu system for the settings.)

Baud rate: 2400 to 115200 Baud
Parity: even, odd, none
1 stop bit

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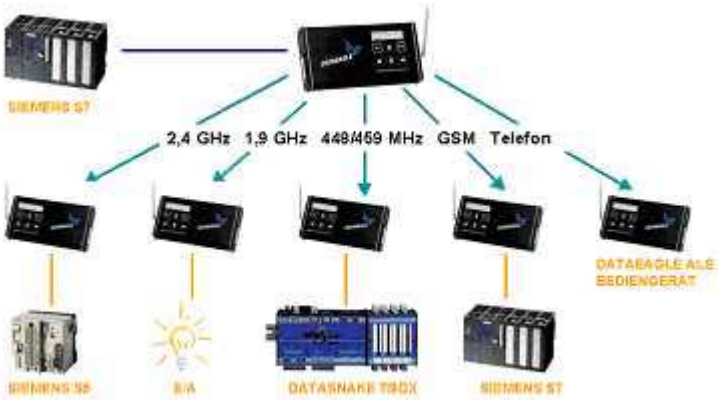
3.2 DE 2000 Functional Description



The DE 2000 family is ideal for linking two or more PLCs (programmable logic controllers). DE 1000 series devices do not have a protocol implemented at the serial interface. DE 2000 series devices have additional, different software protocols. The principle is simple: Each controller to which a DATAEAGLE is connected defines an area in which received data and data to be transmitted are filed – the transmit and the receive drawer. The PLC cyclic program writes the data to be sent to the DATAEAGLE partner via wireless transmission to the transmit drawer and, accordingly, the receive drawer represents the data area received by the remote PLC partner via the DATAEAGLE. Thus, the two DATAEAGLEs merely exchange their respective transmit and receive drawers. This exchange is completely independent of the type of PLC connected to the individual DATAEAGLE. These can be controllers, industrial PCs, input and output subassemblies, or field bus gateways for PROFIBUS DP, SIEMENS MPI BUS or CAN Bus (currently under development). The DATAEAGLE DE 2000 already contains drivers for these hardware interfaces which assume responsibility for the transmit and receive drawers. We call this principle “file drawer operation”.

You may ask: “Why do we do it like this?”. It’s very simple: You save programming time and costs because you can concentrate fully on your data. The transfer function is performed in our DATAEAGLE DE 2000. Depending on the device type and interface, DATAEAGLE then transfers the transmit and receive drawers according to the protocol of the PROFIBUS DP interface, the Siemens S7 MPI interface, the SIEMENS S5 PG interface, 3964R via a CP 341/441 communications unit or a protocol to activate I/O components such as digital 24 V relay inputs/outputs or analog 12bit inputs/outputs.

Within our DE2000 family of devices you can therefore use these file drawers to transmit, for example, data words from a data building block in the SIEMENS S7 200 to a different S7 300 or to a SIEMENS S5 or to I/O subassemblies.

Under the device designation DE 2000 OP, the DATAEAGLE’s display and keyboard can be used as a mobile operator panel. This function corresponds to that of the DATAEAGLE WOPY handheld operator device. The description of the file drawer operation applies to the DE 2100, 2300, 2400, 2500, 2600 and is independent of the frequency band employed. Any required supplements are listed under the description of the individual device type in this manual.

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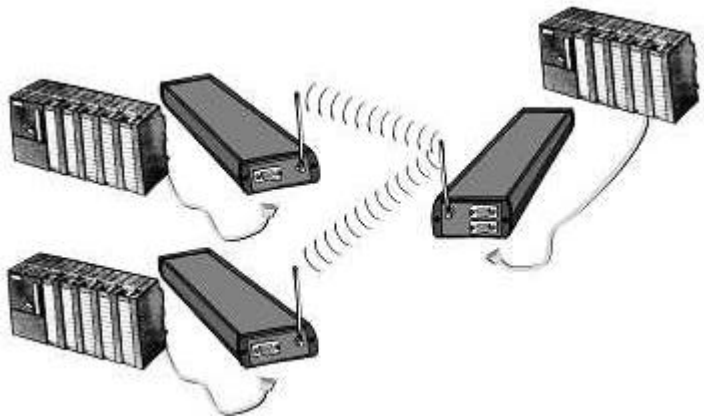
3.2.1 Point-to-Point Connection

The point-to-point connection corresponds to that of the wireless network described in the following. The structure, however, has only a single wireless master and one wireless slave. You must set up one DATAEAGLE as the master and one as the slave. With a point-to-point connection, the controller to which, for example, the master DATAEAGLE is connected is irrelevant.

Controller 1 DATAEAGLE1 DATAEAGLE2 Controller 2

3.2.2 Wireless



One of the outstanding characteristics of the DATAEAGLE DE 2000 wireless modem is its ability to establish not only point-to-point connections but to create an entire network utilizing several DATAEAGLEs.

In wireless network operation, the DATAEAGLE master independently exchanges data with the DATAEAGLE slaves within the wireless network. For this, one DATAEAGLE must be specified as the wireless master and the rest as wireless slaves when the interface driver parameters are defined. For the DE 2000 (2.4GHz), DE 2300 (869MHz), DE 2400 only one master (but multiple slaves) can be defined. With the DE 2100 utilizing the DECT wireless transmission standard, multiple master operation is also possible.

Each PLC is equipped with a DATAEAGLE. All slave subscriber data are sequentially filed in the transmit and receive drawers of the DATAEAGLE at the central PLC (master).

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3.2.3 DE 2x00 Family Driver Settings

The protocols for the hardware interfaces being used are entered under the "**Interface Drivers**" menu item. The following drivers can be selected:

S5 L1 Master	File drawer operation for S5 connection via the PG interface and using the L1 protocol. Data are exchanged using one of the PLC's data building blocks. Refer to DE 2000, Siemens S5
S7 300/400 MPI Bridge	File drawer operation for S7 connection via the MPI interface. This requires the MPI option as the hardware prerequisite. Data are exchanged using one of the PLC's data building blocks. Refer to DE 2000, SIEMENS S7
S7 200 PPI Bridge	File drawer operation for S7 200 via the PPI interface (187 KB). This requires the PPI/MPI option.
Ext. IO Port	Linking external input and output modules. The I/O data are prepared in the file drawer mode in such a way that they are mapped in the data building block of the partner device. This requires the RS485 option. Refer to De 2000, E7A Connection
3964R	This protocol allows data to be read from the controller via an external module.
Profibus DP Slave	Currently under development
Terminal	Operator panel mode. The DATAEAGLE display and keyboard are used as an OP. The messages to be shown on the display are filed in the controller in the form of ASCII characters.

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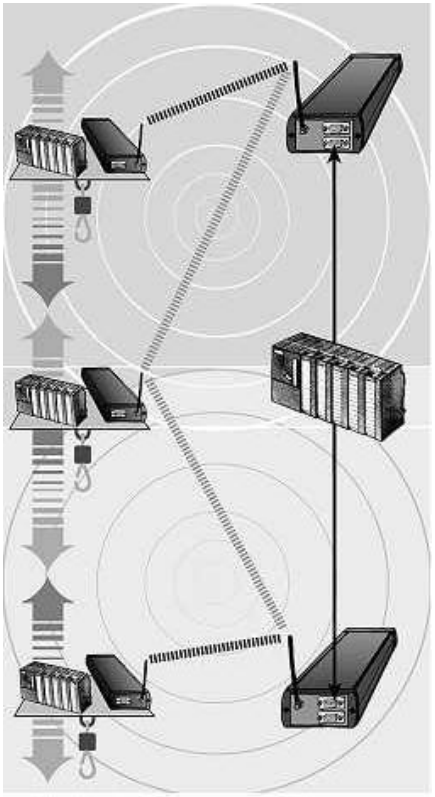
3.2.4 DE 2100 DECT

In Europe, DECT is license-free and offers 250mW of transmitting power. Gain boost antennas up to 12db may be used. DECT is particularly suited for use in conjunction with the DE 2000 family. For new applications, we recommend this device version over the DE 2000.

3.2.4.1 Multi-Master Operation

Multi-master operation is possible if DECT 1.9GHz is employed as the wireless medium – as is the case with the DE 2100. This allows, for example, a mobile subscriber to leave the coverage range of the 1st master and automatically log onto a 2nd master. This changeover takes place automatically, within 100 ms. This allows the operational radius of mobile cranes and transport vehicles to be significantly increased. The DECT wireless protocol permits several wireless cells to be built up (roaming). DE 2100 supports the roaming process. When the parameters of the DE 2100 are defined, the so-called “ARI” numbers of the masters must be entered in the connected slaves via the menu. These numbers act as a common subnet mask, in a manner similar to that for TCP/IP. A slave can only log onto previously released masters. In the reverse direction, this function is also suitable for creating up to 64 independent data links in a single wireless cell, without any of them influencing the others.
For multi-master operation it is important that both masters have the same ARI number. To ensure this, the ARI number of one of the two masters is read from the display menu and then entered in the second master. This ARI number is a unique, 12-digit number.

DE2100 with 2 masters and 3 slaves in 2 overlapping wireless cells



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3.2.4.2 DECT ARI Number

The ARI number consists of 12 digits and a control character (0-9, *). The wireless master has an additional 5-digit DECT number which is part of the ARI number.

The switching rate for the wireless slave can be set as a percentage value. If the values are high, the slave will only search for a new connection if the bit error rate is high. This setting is recommended for a single wireless cell. For a multi-master system, on the other hand, a low value should be set here.

Use the right arrow and power-up to switch the DATAEAGLE to the ARI menu. The ARI number will appear on the wireless master. For multi-master operation, the ARI of a different master can be specified. The wireless slave represents the ARI of the connected wireless master. For new setups, the ARI of the desired wireless master is displayed.

Value	Description	Value range
At the master:		
ARI	Wireless master ARI number	0,1,2,3,4,5,6,7,8,9,*
DECT number	Wireless master DECT number	0,1,2,3,4,5,6,7,8,9
At the slave:		
ARI	ARI number of the connected wireless master (subscripted master)	0,1,2,3,4,5,6,7,8,9,*
Switching rate	Bit error rate changeover threshold	0-99 %

For multi-master operation, both DATAEAGLEs are connected to the central CPU via the MPI interface. From a control perspective, an additional receive data building block must be created for each additional master. Each DATAEAGLE will then file its data at a different location in the PLC. The DATAEAGLEs can file the transmit data in a common data building block, e.g., DB 3. The receipt drawers, on the other hand, must be different (e.g., DB4 for Master 1 and DB 5 for Master 2), otherwise the values from the other controller would be overwritten. The slaves within the wireless range of Master 1 then deliver their data to the DB 4 file drawer, while those in Master 2 deliver to DB5. The application program can then use the changing order counter to determine which master has access to a corresponding slave. In case of a cell change, the changeover occurs within 100 ms. The slave then delivers its data to the other master.

3.2.4.3 Wireless Test for DECT

A quality measurement can be performed at the master. In addition, the field strength at the DE 2100 slave is available in the form of a so-called “RSSI” signal. The value range is from 0 to 125 and is not standardized. Values above 90 are adequate for a data link.

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3.2.5 DE 2300 with 869 MHz

As a DE 2300, the DATAEAGLE can also be used at 869MHz to provide a higher transmitting power of 500mW. The DE 2300 is therefore not as well suited for use with mobile systems and has a significantly slower data transmission speed (comparable with the DE 2400). However, this band is license-free and represents an intermediate step before the DE 2400 operating at 1 Watt of transmitting power, which does require a license.

3.2.6 SIEMENS S5 Connection

The DATAEAGLE is linked to an S5 via the PG interface and the SIEMENS internal L1 protocol. This protocol must be released in the DB1 of the S5's controller. (Refer also to the S5 Manual: L1 Connection).
From the protocol's perspective, the DATAEAGLE is the master and independently writes to and reads from the S5 at regular intervals. The L1 protocol can be activated in every SIEMENS S5.
The following description is based on a DATAEAGLE/S5 connection as a wireless master. The only difference to an S5 as wireless slave lies n the fact that, because of an increase in the length of the data fields in the DB, a wireless master can access several slaves.
It is irrelevant whether or not the DATAEAGLE REMOTE is also connected to an S5. An S5 – S7 connection, S5 – I/O connection, etc. can be established following the same principle. The file drawer principle ensures compatibility.

3.2.6.1 DATAEAGLE Settings

"L1 Master" must be selected in the "Interface Driver" main menu. The setting for the transmit and receive drawer is made at the controller in DB1. In this menu, one DATAEAGLE must be defined as the wireless master and the DE REMOTE as the wireless slave. In the case of a point-to-point connection it does not matter which of the DATAEAGLEs is the master and which is the slave.
Settings in the controller

```
  0:     KC ='DB1 OBA: AI 0 ; OBI:    ';
 12:     KC ='    ; OBC: CAP N     CBP ';
 24:     KC ='N       ;#SL1: SLN 1  SF ';
 36:     KC ='DB2  DW0   EF DB3  DW0   ';
 48:     KC ='  KBE MB100      KBS MB1';
 60:     KC ='01       PGN 1  ;# SDP: N';
 72:     KC ='T 128 PBUS N ; TFD: 0013';
 84:     KC ='  100    ; #CLP: STW MW10';
 96:     KC ='2         CLK DB5  DW0   ';
108:     KC ='  SET 3  01.10.91 12:00:';
120:     KC ='00    OHS 000000:00:00  ';
132:     KC ='  TIS 3 01.10. 12:00:00 ';
144:     KC ='   STP Y SAV Y  CF 00    ';
156:     KC =' ; # #RKT: PAR DB202DW0 ';
168:     KC ='  SF DB203DW0   EF DB204';
180:     KC ='DW0   KBS MB104      KBE';
192:     KC ='  MB105      MOD 1  BDR  ';
204:     KC ='9600 PRTY EVEN DF 1  DT ';
216:     KC ='220    PRI HIGH TID 2000';
228:     KC ='   BWT 4000    TTE 6     ';
240:     KC ='TTS 6   ;#  #ASC:  PAR   ';
252:     KC ='DB202DW0   SF DB203DW0   ';
264:     KC =' EF DB204DW0   KBS MB104';
276:     KC ='      KBE MB105      MOD';
288:     KC ='  1 BDR 9600 PRTY EVEN   ';
300:     KC ='DF 0 DT 100    ML 64    ;';
312:     KC =' # END   ';
```

DB1 of a SIEMENS S5 95U after "initial deletion"

In order to activate the L1 link, the two pound symbols (#) must be replaced by a space.
(24: and 60:)

The controller must have L1 address 1: SLN 1

In the original state, the transmit drawer is located in data module DB2, starting with data word DW0, and the receive draw is in DB3, starting at DW0.

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- For the S5 connection, the DATAEAGLE is linked to the controller as the SINEC L1 master, with the controller having the SINEC L1 address 1 (entry in the DB1: SLN1).
- Marker byte KBE (M100), bit 7, handles the release for receipt from the DATAEAGLE.
- M100.2 indicates whether an L1 data framework was received.
- Marker byte KBS (M101), bit 7, handles the release for data transmission.
- On the PLC side, a maximum of 64 data bytes can be read or written!

```
  0:    KC ='DB1 DBA: AI 0 ; DBI:    ';
 12:    KC ='   ; DBC: CAP N     CBP ';
 24:    KC ='N      ;SL1: SLN 1  SF  ';
 36:    KC ='DB4  DW0   EF DB5  DW0  ';
 48:    KC ='  KBE MB100      KBS MB1';
 60:    KC ='01      PGN 1  ; SDP: N ';
 72:    KC ='T 128 PBUS N ; TFB: OB13';
 84:    KC =' 100    ; #CLP: STW MW10';
 96:    KC ='2        CLK DB5  DW0   ';
108:    KC ='  SET 3  01.10.91 12:00:';
120:    KC ='00    OHS 000000:00:00  ';
132:    KC ='  TIS 3 01.10. 12:00:00 ';
144:    KC ='   STP Y SAV Y  CF 00   ';
156:    KC =' ; # #RKT: PAR DB202DW0 ';
168:    KC ='  SF DB203DW0   EF DB204';
180:    KC ='DW0   KBS MB104      KBE';
192:    KC =' MB105      MOD 1  BDR  ';
204:    KC ='9600 PRTY EVEN DF 1  DT ';
216:    KC ='220    PRI HIGH TIO 2000';
228:    KC ='   BWT 4000    TTE 6    ';
240:    KC ='TTS 6   ;#  #ASC:  PAR  ';
252:    KC ='DB202DW0   SF DB203DW0  ';
264:    KC =' EF DB204DW0   KBS MB104';
276:    KC ='      KBE MB105      MOD';
288:    KC =' 1 BDR 9600 PRTY EVEN   ';
300:    KC ='DF 0 DT 100    ML 64   ;';
312:    KC =' # END  ';
```

Modified DB1 of a SIEMENS S5 95U

- SLN 1 S5 address 1
- SF DB4 DW0 DB4 transmit drawer, beginning at data word 0
- EF DB5 DW0 DB5 receipt drawer, beginning at data word 0

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The following description illustrates the setup of the transmit and receive drawers of an S5 as a wireless master with two connected slaves with three transmit and receive data words (6 bytes).

Master transmit drawer:

Master transmit drawer		Function	
DW0_H	DW0_L	L1 length (64 maximum) [1]	Source = 0
DW1_H	DW1_L	Order number [2]	1st slave address [3] (partner station address)
DW2_H	DW2_L	No. of utility data bytes in the receive drawer, starting at DW3.	No. of utility data bytes in the transmit drawer, starting at DW3.
DW3		1st+2nd utility bytes for slave 1	
DW4		3rd+4th utility bytes for slave 1	
DW5		5th+6th utility bytes for slave 1 (64 utility data bytes maximum)	
DW6_H	DW6_ L	Order number	2nd slave address (partner station address)
DW7_H	DW7_L	No. of utility data bytes in the receive drawer, starting at DW8	No. of utility data bytes in the transmit drawer, starting at DW8
DW8		1st+2nd utility bytes for slave 2	
DW9		3rd+4th utility bytes for slave 2	
DW10		5th+6th utility bytes for slave 2 (64 utility data bytes maximum)	
DW11		0 = No additional slaves	

Data word 0 is an integral component of the SINEC L1 data framework!

Master receive drawer:

Master receive drawer		Function	
DW0_H	DW0_L	L1 length (64 maximum) [4]	Source = 0
DW1_H	DW1_L	Order number +1[5]	1st slave address [6] (partner station address)
DW2_H	DW2_L	No. of utility data bytes in the receive drawer, starting at DW3.	No. of utility data bytes in the transmit drawer, starting at DW3.
DW3		1st+2nd utility bytes for slave 1	
DW4		3rd+4th utility bytes for slave 1	
DW5		5th+6th utility bytes for slave 1 (64 utility data bytes maximum)	
DW6_H	DW6_ L	Order number +1	2nd slave address from the DE REMOTE
DW7_H	DW7_L	Copy no. of utility data bytes from the DE REMOTE	Copy no. of utility data bytes from the DE REMOTE
DW8		1st+2nd utility bytes for slave 2	

[1] L1 length = (no. of slaves * (no. of utility data bytes per slave +4)) + 2
[2] The order number is used to check the data transfer. The slave PLC can, for example, increase the value by 1 in order to indicate proper receipt.
[3] Wireless partner 0 = End of the subscriber list
[4] L1 length = (no. of slaves * (no. of utility data bytes per slave +4)) + 2
[5] The order number is used to check the data transfer. The slave PLC can, for example, increase the value by 1 in order to indicate proper receipt.
[6] Wireless partner 0 = End of the subscriber list

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DW9	3rd+4th utility bytes for slave 2
DW10	5th+6th utility bytes for slave 2 (64 utility data bytes maximum)
DW11	0 = No additional slaves

Application example with 16 digital inputs and 16 digital outputs. The map for the outputs is located in DB2, DW3, and for the inputs, in DB3, DW4. The proper assignment of the data words is due to the preconfiguration at the factory. These assignments can vary, depending on the building block combination. The assignment is documented on a supplementary sheet on delivery.

Example:

DB2 DW1 "Partner station address" is the address defined as the own station address in the partner DATAEAGLE.
DB2 DW3 Map for the building block with 16 outputs
DB3 DW4 Map for the building block with 16 inputs

If the SIEMENS S5 is merely a wireless slave, only the transmit and receive area will be shorter.

Slave transmit and receive drawer		Function	
DW0_H	DW0_L	L1 length (64 maximum) [7]	Source = 0
DW1_H	DW1_L	Order number [8]	Partner station address [9]
DW2_H	DW2_L	No. of utility data bytes in the receive drawer, starting at DW3	No. of utility data bytes in the transmit drawer, starting at DW3
DW3		1st utility data byte	
...		...	
DW3+n		64 utility data bytes maximum	

[7] L1 length = (no. of slaves * (no. of utility data bytes per slave +4)) + 2
[8] The order number is used to check the data transfer. The slave PLC can, for example, increase the value by 1 in order to indicate proper receipt.
[9] Wireless partner 0 = End of the subscriber list

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3.2.7 SIEMENS S7 MPI Connection

This description applies to all DATAEAGLEs with an MPI interface, regardless of the frequency band used.

For S7 – S7 connection, the DATAEAGLE is an MPI master, that it, it assumes writing to the controller and reading from the controller completely independently. For this, one data building block for transmission and one data building block for receipt are defined in the DATAEAGLE menu. For communications with the S7, no additional functional modules, global data agreements, or any other settings are required in the S7 itself. To establish the link to the S7-3xx/4xx controller, “MPI Bridge” is selected in the “Interface Driver” main menu. Refer to S7 commissioning.

Attention risk of potential errors

- Wireless addresses are entered as decimal values in the DATAEAGLE. Remember to also enter the slave addresses as decimal values into the DB (data building block).
- The DE 2x00 requires the optional MPI interface, part no. 10293.
- Data building blocks with at least 104 DW (data words) must be created in the PLC transmit and receipt drawers!
- On the master PLC side, up to 104 data words can be used for the overall network.
- On the slave PLC side, up to 104 data words can also be read or written to, starting with data word 0!
- If multiple slave PLCs are used, the useable data length is based on the maximum of 104 DW in the master PLC. If larger data volumes are required, we recommend a 3964 R link to the master via a CP module (CP 341 / CP 441).
- The specification of the number of utility data bytes must be an even number!
- The setting for the wireless partner address on the master DATAEAGLE is ignored because address specification takes place in the data words!
- In the transmit drawer, a partner address of 0 indicates the end of the wireless subscriber list. Any subsequent data words will be deleted in the DATAEAGLE.
- A partner address of FF will completely bypass the parameter block. This allows a slave to be temporarily disconnected from the wireless protocol.
- Theoretically, there can be up to 98 subscribers in the network.

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3.2.7.1 Transmit and Receive Drawer Structure at the S7:

Master transmit drawer:

Master transmit drawer	Function
DBB0	Order number [10]
DBB1	1st slave address [11] (partner station address)
DBB2	No. of utility data bytes in the receive drawer, starting at DBB4
DBB3	No. of utility data bytes in the transmit drawer, starting at DBB4
DBB4	1st utility data byte
....	
DBBn	Up to a maximum of 28 utility data bytes
DBBn+1	Order number
DBBn+2	2nd slave address (partner station address)
DBBn+3	No. of utility data bytes in the receive drawer, starting at DBBn+5
DBBn+4	No. of utility data bytes in the transmit drawer, starting at DBBn+5
DBBn+5	1st utility data byte
....	
DBBn+33	Up to a maximum of 28 utility data bytes
DBBn+34	0 = End of the subscriber list

n = consecutively incrementing byte counter
DBB = Data building block byte

Master receive drawer: (information filled in by the DATAEAGLE)

Master receive drawer	Function
DBB0	Order number
DBB1	1st slave address (partner station address)
DBB2	No. of utility data bytes in the receive drawer, starting at DBB4
DBB3	No. of utility data bytes in the transmit drawer, starting at DBB4
DBB4	1st utility data byte
DBBn	Up to a maximum of 28 utility data bytes
DBBn+1	Order number
DBBn+2	2nd slave address (partner station address)
DBBn+3	No. of utility data bytes in the receive drawer, starting at DBBn+5
DBBn+4	No. of utility data bytes in the transmit drawer, starting at DBBn+5
DBBn+5	1st utility data byte
....	
DBBn+33	Up to a maximum of 28 utility data bytes
DBBn+34	0 = End of the subscriber list

If the SIEMENS S7 controller is merely a wireless slave, the transmit and receive area is shortened.

[10] The order number is used to check the data transfer. The slave PLC can, for example, increase the value by 1 in order to indicate proper receipt
[11] Wireless partner 0 = End of the subscriber list

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Slave transmit and receive drawer:

Slave transmit and receive drawer	Function
DBB0	Order number
DBB1	Wireless master address
DBB2	No. of utility data bytes in the receive drawer, starting at DBB4
DBB3	No. of utility data bytes in the transmit drawer, starting at DBB4
DBB4	1st utility data byte
....	
DBBn	Up to a maximum of 208 utility data bytes

Screen copy for the variable status of the transmit and receive drawer of a DE 2000 S7 MPI. A 16-bit input component is connected to the DATAEAGLE partner.

Operand	Symbol	Statusformat	Statuswert	Steuerwert	
// Senden					
DB3.DBB 0	---	DEZ	50	50	Order counter DE 2000 station address
DB3.DBB 1	---	DEZ	2	2	
DB3.DBB 2	---	DEZ	2	2	2 byte receive drawer 0 byte transmit drawer
DB3.DBB 3	---	DEZ	0	0	
DB3.DBB 4	---	DEZ	0	0	
DB3.DBB 5	---	DEZ	0	0	
DB3.DBB 6	---	DEZ	0	0	
DB3.DBB 7	---	DEZ	0	0	
DB3.DBB 8	---	DEZ	0	0	
// Empfangen					(Filled in by S7)
DB4.DBB 0	---	DEZ	51	---	Order counter +1 Partner function address
DB4.DBB 1	---	DEZ	2	---	
DB4.DBB 2	---	DEZ	2	---	2 byte receive drawer 0 byte transmit drawer
DB4.DBB 3	---	DEZ	0	---	
DB4.DBB 4	---	BIN	2#1111_1111	---	Input mode high byte L byte (D0 input = high)
DB4.DBB 5	---	BIN	2#1111_1110	---	
DB4.DBB 6	---	BIN	2#0000_0000	---	
DB4.DBB 7	---	BIN	2#0000_0000	---	
DB4.DBB 8	---	BIN	2#0000_0000	---	

Remember that the wireless addresses and the length data must be specified in decimal format. While this is primarily a problem in the statement in Step 7, we have found that it is more frequently a source of errors during commissioning. No transmission can be established if the slave address is incorrectly provided.

Setting in the DATAEAGLE station address: 20 DEC - Setting in the DB: 14 HEX

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3.2.7.2 Life Bit – Monitoring the Transmission with the Order Number

3.2.7.2.1 Slave Mode

In the slave mode, the order number must be incremented and monitored by the PLC cycle program itself. The following sample program in the controller to monitor the wireless data transmission can use the order number byte. If this is done, the order number is incremented at each data transmission.

3.2.7.2.2 Slave PLUS Mode

There is also an automatic mode for the order number. With this, DATAEAGLE increments the receive drawer order number at each data transmission and copies this counter to the transmit drawer. A simple check by the PLC program can be performed by having a timer reset each time the number changes. Incrementation is in binary code, that is, the lowest value bit toggles at the highest frequency. This too can be used to start a monoflop function.

Setting the PLUS mode takes place via the menu:

Interface Drivers
MPI Bridge
SLAVE + (if the slave in question is the wireless slave)

Automatic incrementation by the DATAEAGLE has one small disadvantage:

In the PLUS mode, there is no check of the partner controller's interface to determine whether it is in the stop mode or is even running. If you wish to have this determined from the central controller, you should have the order counter incrementation performed by the cycle program.

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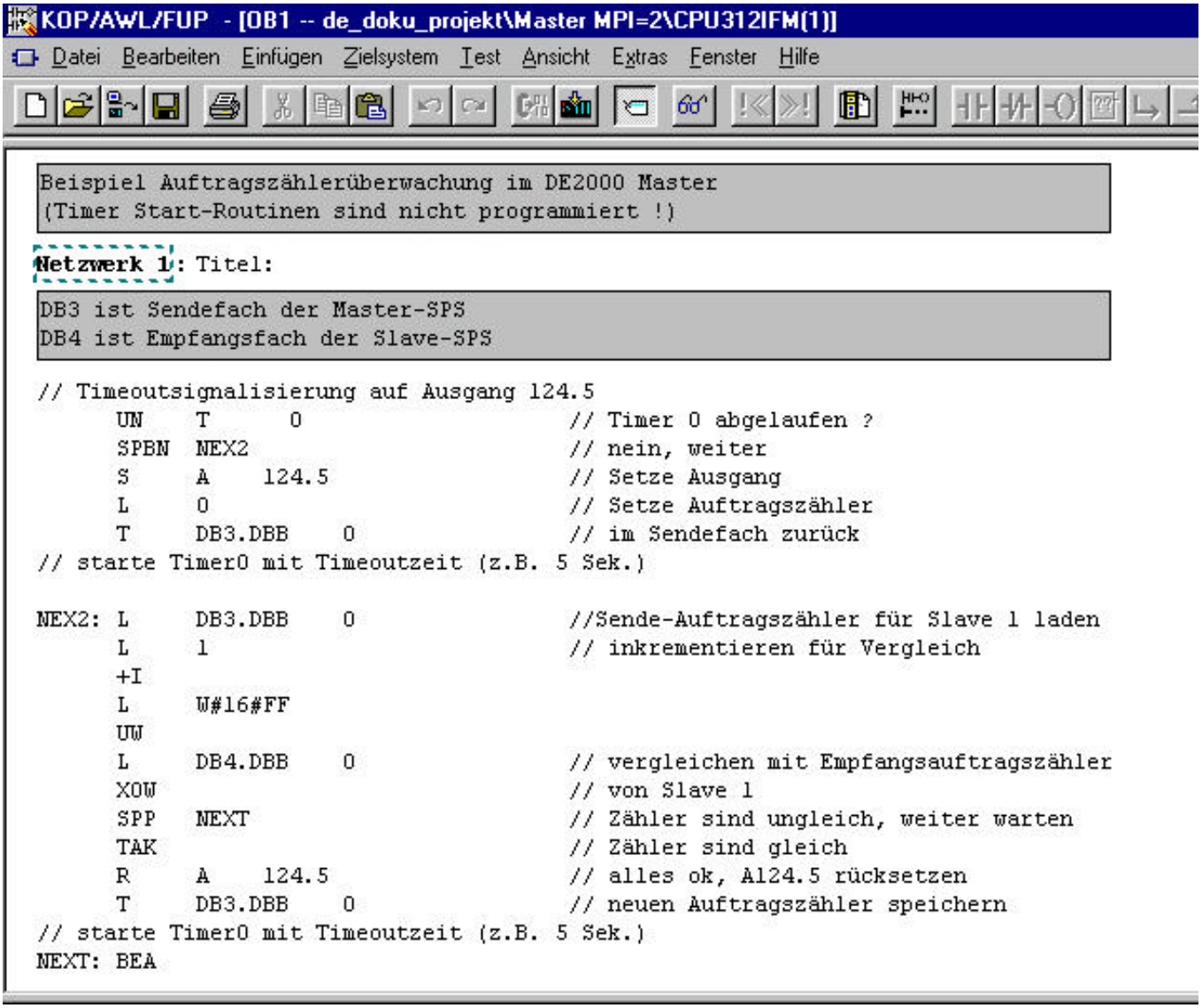
Routine at the wireless master



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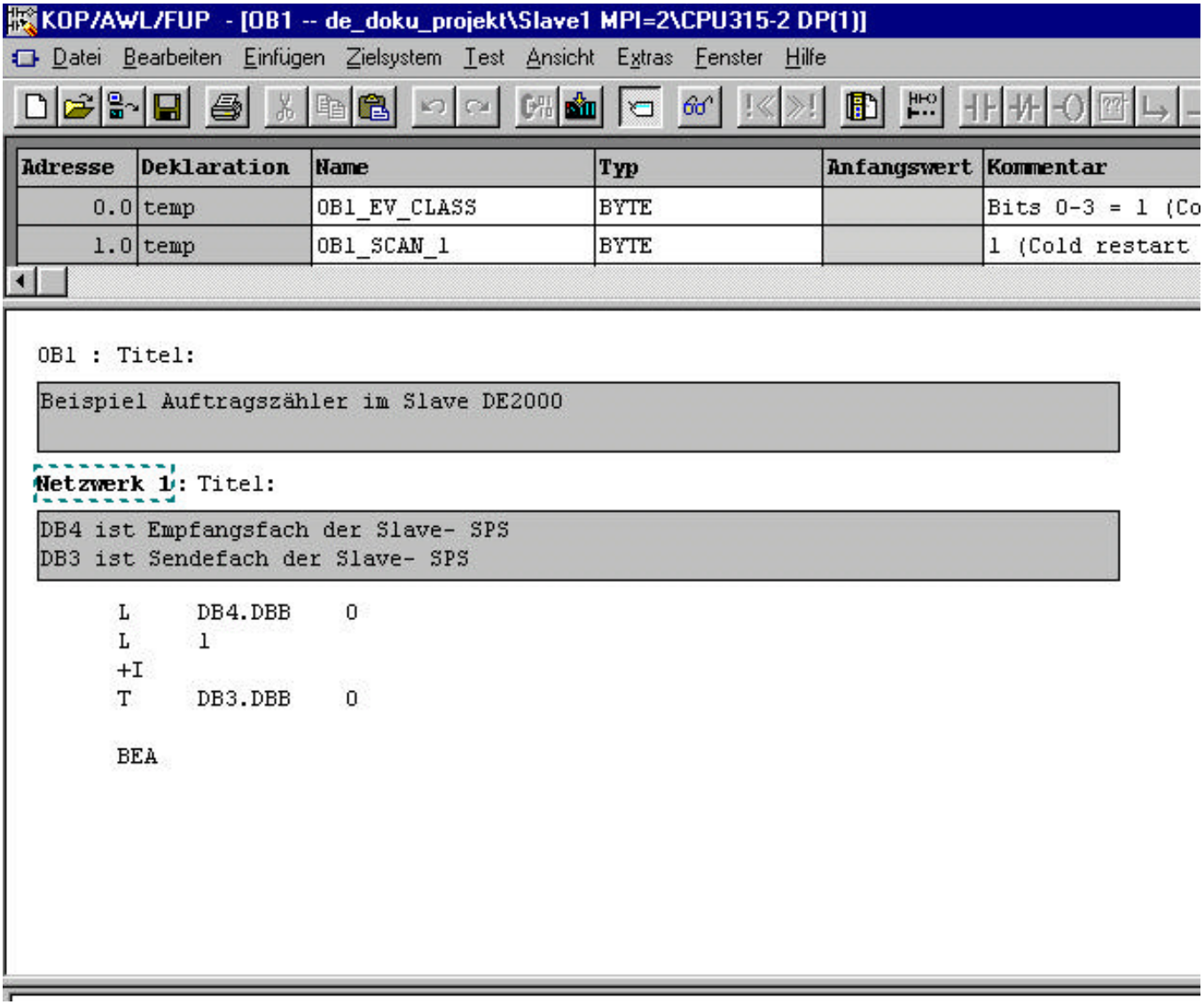
Routine at the wireless slave



3.2.7.3 Data Inconsistency

Data inconsistencies may arise between the transmit and receive drawers wit the MPI interface. This can result in invalid values for associated data words. The S7 300 writes 8 bytes and the S7 400 writes 32 bytes to a block. Under these circumstances the lower data words may be newer than the higher ones.

Solution: Use the highest data word as the an own order counter. Once this value changes, the lower data words will also be new.

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3.2.7.4 Calculating Transmission Times

The transmission time of one word from the one controller to another and back via wireless transmission is made up of several individual time increments:

1. Controller 1 cycle program	2 ms
2. Reading data from controller 1 via the MPI	68 ms
3. Wireless transmission from controller 1 to controller 2	10 ms
4. Writing data to controller 2 via the MPI	81 ms
5. Controller 2 cycle program	2 ms
6. MPI query time period	200 ms
Transmission time in one direction	363ms
7. Controller 2 cycle program	2 ms
8. Reading data from controller 2 via the MPI	68 ms
9. Wireless transmission from controller 2 to controller 1	10 ms
10. Writing data to controller 1 via the MPI	81 ms
11. Controller 1 cycle program	2 ms
12. MPI query time period	200 ms
Transmission time in both directions	726ms

Each of these individual time increments is variable and can depend on, for example, the number of bytes being transferred, the quality of the wireless connection, the controller cycle times, and the number of subscribers on the MPI bus. The above example is based on the transmission of 20 DW in both directions. The MPI query time period at the DATAEAGLE can be adjusted from approx. 70 – 800 ms. In this example, 200 ms were set. Where the quality of the wireless connection is poor, the value can increase from 10 ms (times 3 and 9) to 70 ms each.

In a wireless network, the values in steps 3 and 9 are multiplied by the number of wireless slaves.

If you experience timing problems, we recommend the 3964 R link via a serial component.

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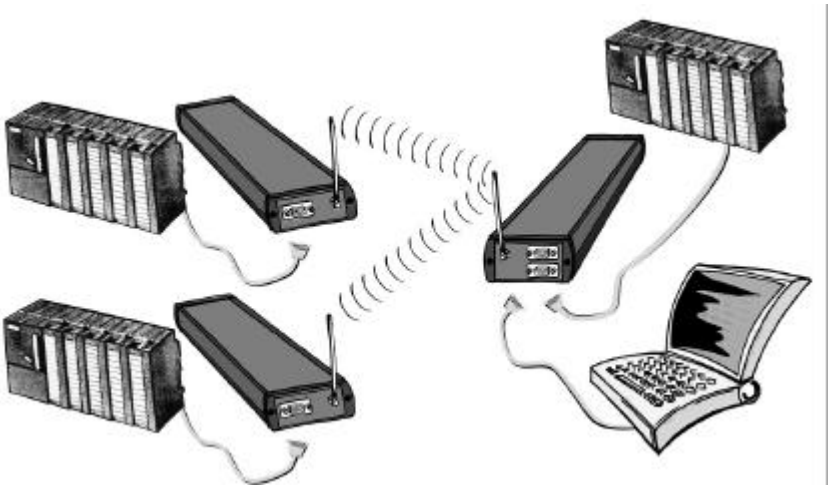
3.2.7.5 DE 2x00, Step7 Programming for File Drawer Operation

The remote maintenance device option is a combination of DE 2000 and DE 5000 units. Using this, you can access the remote S7 controller via Step 7 or other programming software. Clicking on “ENTER” on the DATAEAGLE at the master controller opens a menu from which the MPI address of the remote CPU can be selected. After specifying the address, a transparent MPI link is established. File drawer operation is not possible during this time. Canceling the programming mode returns you to the menu from which you can reenter the automatic file drawer mode.

This mode is practical if, for example, the remote device is difficult to access, e.g., if it is in a crane or located at some distance.



All Step 7 functions that can be performed by hard-wired connections are also available via the wireless link. However, the MPI bus after the wireless link is only connected to a single MPI subscriber.

- This function does not operate with the S7 200.
- Can be implemented with the DE2000/ DE2100/ DE2300/ DE2500.
- Neither does this function operate with DE2400 timeslot techniques.

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3.2.7.6 S7 200 PPI Commissioning

Only the PPI protocol with 187.5 KB is supported.

- Select the “PPI Bridge” driver from the “Change Interface Driver?” menu and confirm your selection with “Enter”.

- Set the wireless operating mode (Master/ Slave/ Slave+) and wireless poll rate and confirm with “Enter”.

- Enter the PPI addresses (SA = DATAEAGLE PPI address, PA = S7 PPI address). Filing of the received data is specified in the menu by defining “Offset VW: nnn”. An offset of 100 indicates that the receive drawer starts at VB100. Please make sure that the transmit and receive drawers do not overlap!

The S7 200 does not contain any data building blocks, but merely a data area = variable building block. This is where the data for the transmit and receive drawer are sequentially filed. The transmit data are located starting at variable byte 0 VB0, just as with the S7 300 link. Here too, the transmit drawer ends with 00.

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3.2.7.7 S7 300/400 MPI Commissioning (S5 in Parentheses)

- Connect the power supplies and interface cables. The devices register with "**DE xxxx Vx.x xxxx
  "x" indicates the current hardware and software versions.

- Define the partner and station addresses in the "Change Device Addresses?" menu.

  For example, enter the following wireless addresses:

  DATAEAGLE 1 (subsequently the wireless master)
  Station address =10
  Partner address =20

  DATAEAGLE 2 (subsequently the wireless slave)
  Station address 20
  Partner address 10

  Any desired station and partner addresses from 1 to 99 can be assigned.
  For security, please note these addresses on a separate piece of paper for each DATAEAGLE. There are then some additional settings that must be made.

- Perform a quality check in the "Wireless Channel Functions" menu and, if required, select a wireless channel. Where there is a good wireless connection, the DATAEAGLE displays a quality of at least 09. If no wireless connection can be established, the display reads "---". In this case, select a different channel.
  Refer also to the "Change Wireless Channel" menu item.
  From this point on you should have a wireless connection!

- Select the link in the "Change Interface Driver" menu. For S7, select "MPI Bridge". For S5, select "Sinec L1 Master".

- S5 and S7 MPI wireless master/wireless slave settings
  If you selected "MPI Bridge", click on "ENTER". In the menu that then appears, define the DATAEAGLE function as either the wireless master or wireless slave. Assign the role of wireless master to the DATAEAGLE 1 and the role of wireless slave to the DATAEAGLE 2. Which device is defined as the wireless master and which as the wireless slave is only important in a wireless network.

  In the same menu, you can use the "Cycle" item to specify the frequency with which the master will transmit data to the slaves. Normally, enter a value of "AUTO" here. Alternately, you can also select 0.5/1/10 seconds.

Wireless Master/Slave, **Cycle: AUTO/0.5/1/10 s**

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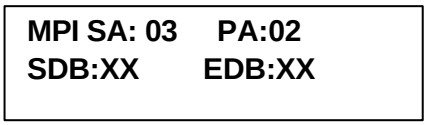
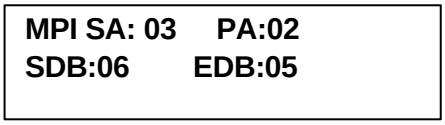
- S7 MPI address setting (not required for S5)
  With a SIEMENS S7 MPI link, the MPI addresses of the automation device and of the DATAEAGLE are specified in a parameter menu. If you are not sure of the S7 controller's MPI address, use the "Available Subscribers" Step 7 option and use the address indicated under "PA". Then enter an available and as yet unassigned MPI controller address under "SA" for the DATAEAGLE.



- S7 transmit and receive building block
  You must also enter the transmit or receive building block here.

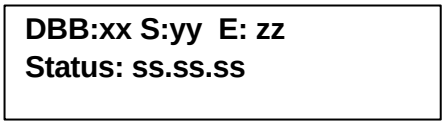
  This menu does not appear for the SIEMENS S5 L1 link. The data building block is specified in the automation device's OB1. Refer to 0, S5 link



  In this example, the transmit drawer is located in data building block DB6, starting at DW0, and the receive drawer in DB5, starting at DW0:

MPI SA	MPI Station Address of the DATAEAGLE (suggested = 3) Must not already be assigned within the MPI network. Normally, PG = 0
MPI PA	MPI Partner Address of the SIEMENS S7 controller (normally = 2)
SDB	Number of the Send Data Building block (PLC transmit drawer, that is, data **to** the partner)
EDB	Number of the receive Building block (PLC receive drawer, that is, data **from** the partner)

- Test the DATAEAGLE – S7 MPI link
  DE 2000 units have a mode that will test the link to the connected controller. "ENTER" now takes you to the next menu item, "STATUS". Refer to "MPI Status Query" (Section 3.2.7.8).



  You must now use Step 7 to create two data building blocks, each with at least 100 data words: In our example, these are DB 3 and DB4.
  If you see "01.FF.FF" under "STATUS", communications with the S7 have been established via MPI. (Refer to S7 MPI Status Query)

  In the topmost line you can now select and check the bytes in the data building block read from the controller. Using the arrow key, you can enter the byte to be displayed in

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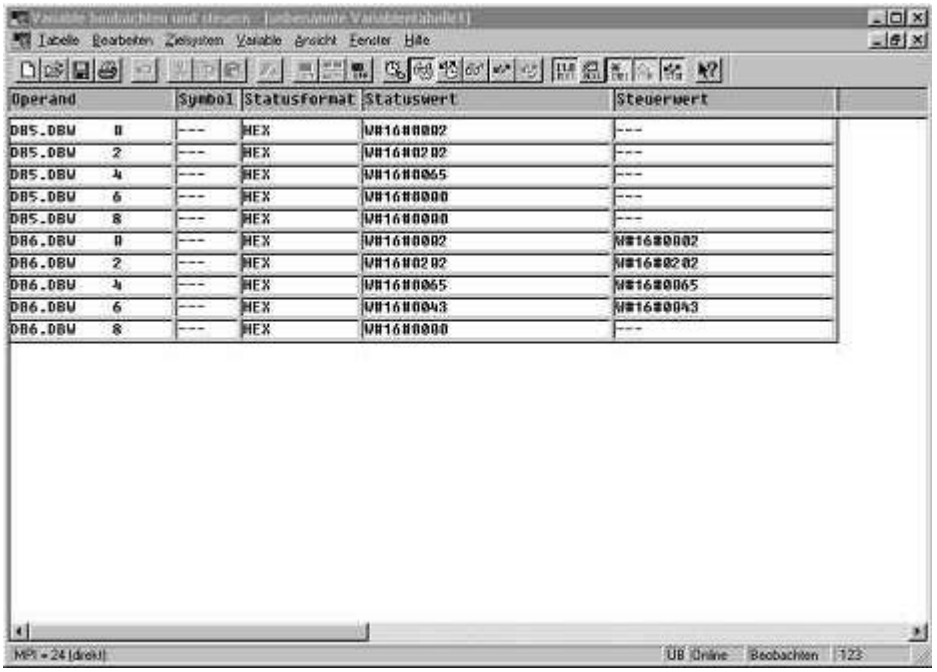
the “DBB” field. The “S” field shows the transmit drawer, and the “E” field the receive drawer.

- Loopback test for the DATAEAGLE 2
  At this point, you have only set the parameters for the DATAEAGLE 1, the wireless master.
  At this point, you do not yet need a PLC controller for the second DATAEAGLE.
  Using the “Loopback” test, the second DATAEAGLE merely reflects the received data words back to the controller.
  To perform this test, set “Change Interface Driver” in DATAEAGLE 2 to “Loopback”.

- Setting the transmit building block parameters

  Now use the “Control Variables” function in Step 7 to create a variables table as follows:



  The controller 1 transmit drawer is located in DB6, and the receive drawer in DB5.
  DB6.DW0 is the order counter byte (=00) and the wireless partner address 2 of the salve being connected. The length of data word 2 is 2 bytes, for transmitting and receiving. The first utility data word (Hex 65) is located in data word 4. the second utility data word (Hex 43) is not transmitted because the specified length is only 2 bytes. If Hex 0404 were entered in DW2, the second utility data word would also be transmitted and reflected.

- If the above was successful, perform the same procedure for the wireless slave.

- Press the “ESC” to return both units to the base menu.
  The wireless master establishes the link to the wireless slave.

Important:
If you are operating in a wireless network (multiple slaves connected to a master controller) the DATAEAGLE at the master PLC must be defined as the wireless master and the DATAEAGLE at the slave PLC or the I/O ports must be defined as the wireless slave!

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3.2.7.8 MPI Status Query

Using the integrated status query function, the communications link to the S7 can be tested from the DATAEAGLE. This allows you to test whether the data building blocks have been set up correctly, whether the S7 is available, and whether the connecting cable is OK.

In addition, the contents of the controller's transmit and receive drawer can be viewed on the DATAEAGLE display.

Procedure: (refer also to the menu structure)

- Switch the DE on.
- Use "🡐" or "🡒" to enter the password menu.
- Using the arrow keys, set the password (default value = "00") and confirm with "ENTER".
- Use "🡒" to switch to the "Change Interface Driver" menu.
- Use "ENTER" to open the next submenu.
- Use "🡑" or "🡓" to switch to the "MPI Bridge Driver" menu and confirm with "ENTER".
- Use "🡑" or "🡓" to select the wireless master or wireless slave and confirm with "ENTER".
- Define the MPI station address, partner address, transmit DB, and receive DB and confirm with "ENTER".
- You are now in the "Status" menu.
- Use "🡑" or "🡓" to enter the data building block byte in the "DBB" field.
  The "S" field then shows the contents of the transmit drawer and the "E" field the contents of the receive drawer.

DBB:04 S:01 E:02 **Status: aa.bb.cc**

- The following status information can be displayed in the second line:

aa = 01	Bus ok.
aa = Cx	MPI alone on the bus
aa = 4x	No partner available (incorrect partner address)

bb = FF	Read ok.
bb = 0A	No data available (DB not created)

cc = FF	Write ok
cc = 0A	No data available (DB not created)

Message indicating a positive communications status with the S7 via MPI:

DBB:xx S:yy E: zz **Status: 01.FF.FF**

- Use "ESC" to return to the base menu.

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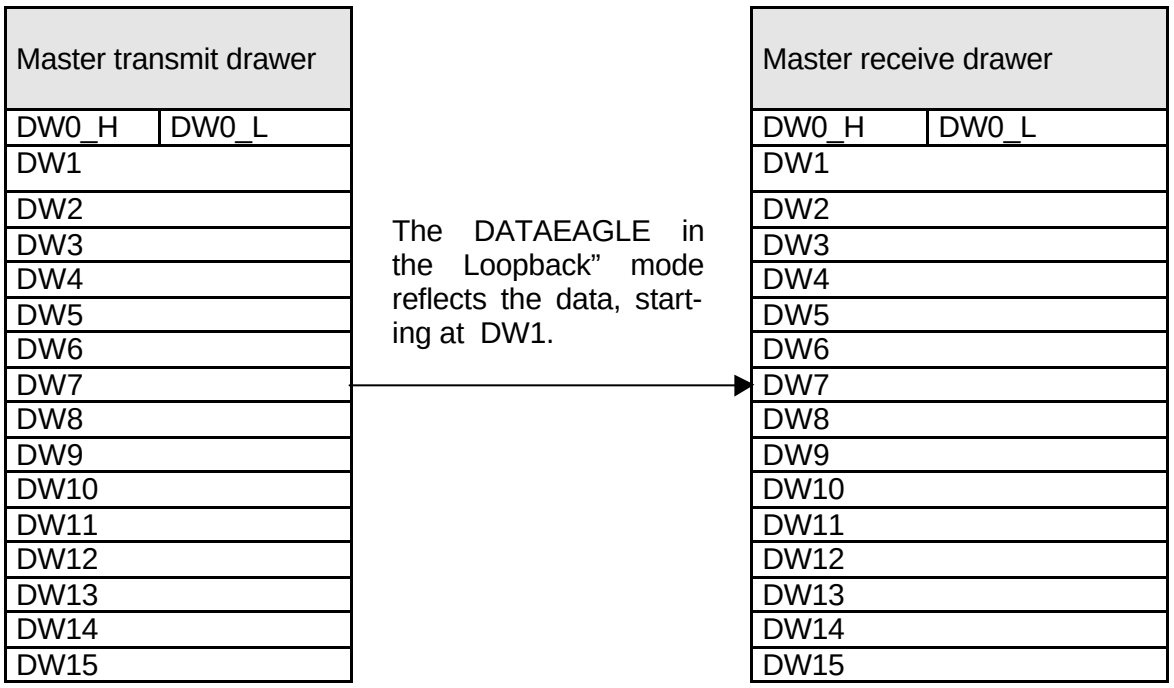
3.2.8 LOOPBACK Test Without a Connected Controller

Loopback is a test mode to simulate a PLC / PLC link to a single controller. For this, one DATAEAGLE is connected to one PLC while the second DATAEAGLE runs in the loopback mode.

The DATAEAGLE running in the loopback mode does not need to have a controller connected to its hardware interface. The function merely consists of copying a data package received from the partner device and then sending it back to the partner's receive drawer. This test mode is designed for use during commissioning in order to check the transmission path as well as the link between a DATAEAGLE and the controller. The values entered in the controller's transmit drawer with, for example, control/status variables, then appear in the receive drawer.



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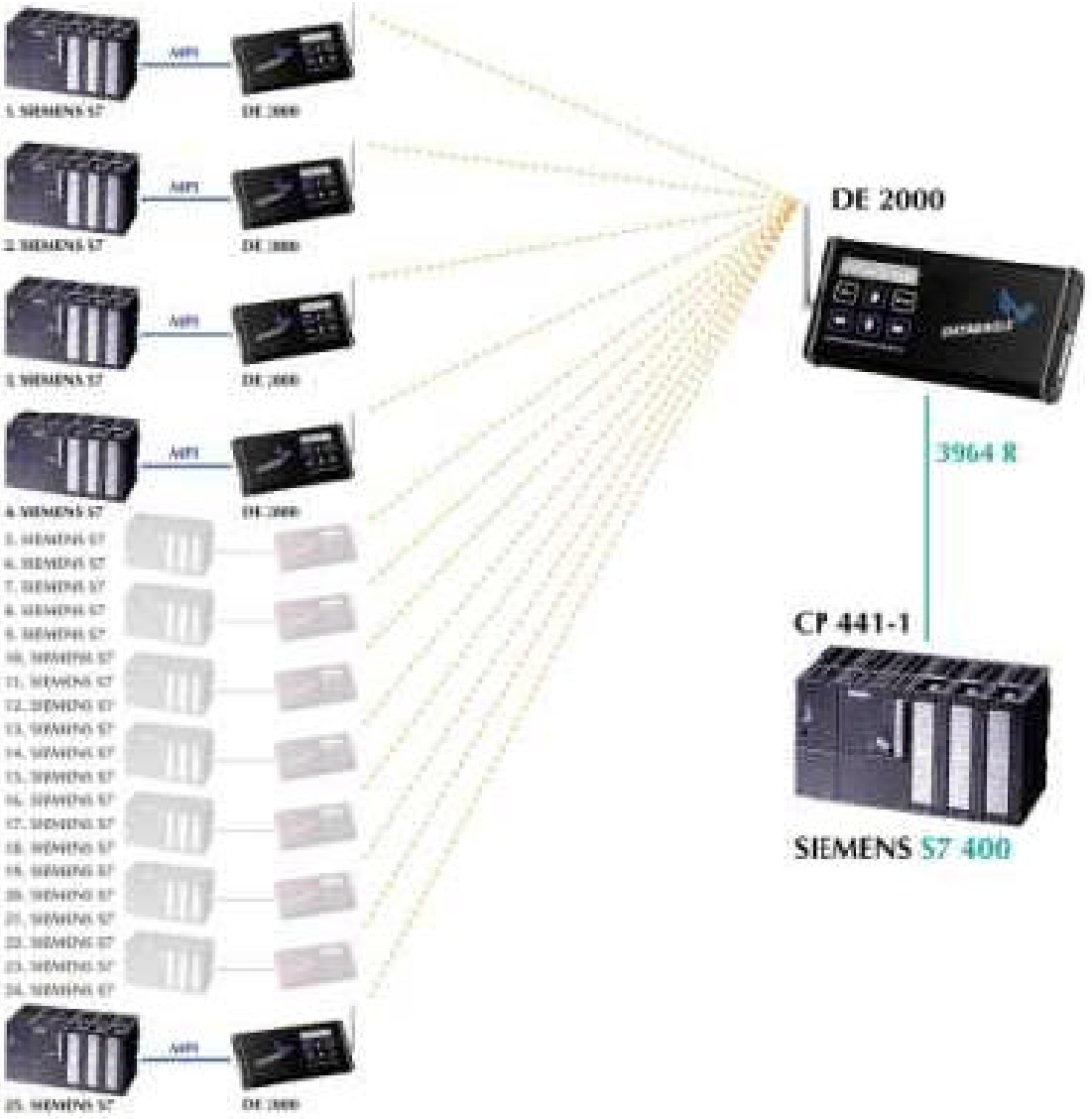
3.2.9 SIEMENS 3964R Link

The most economical controller link is via an always available programming device interface. For S7, this is the MPI interface. This interface is adequate for 95% of all applications and is ideally suited for this task. However, if larger wireless networks are to be created, the data volume involved will soon approach maximum limits. In this case, we recommend a communications module in the PLC (e.g., CP341 or CP441 for the S7 300 or 400, respectively) as the link to the central controller.



In the above example from the engine building department of a large automobile manufacturer, an S7 400 central controller supplies 25 driverless transport systems, each equipped with an S7 300, with data via a wireless link. A CP441-1 module using 3964R protocol is used to establish the link to the central controller. This link allows up to 1,000 data words to be read and written.

The transmit and receive drawer structure is identical to that for the MPI interface. The only additional task is to include the functional building blocks for the CP module in the cycle program.

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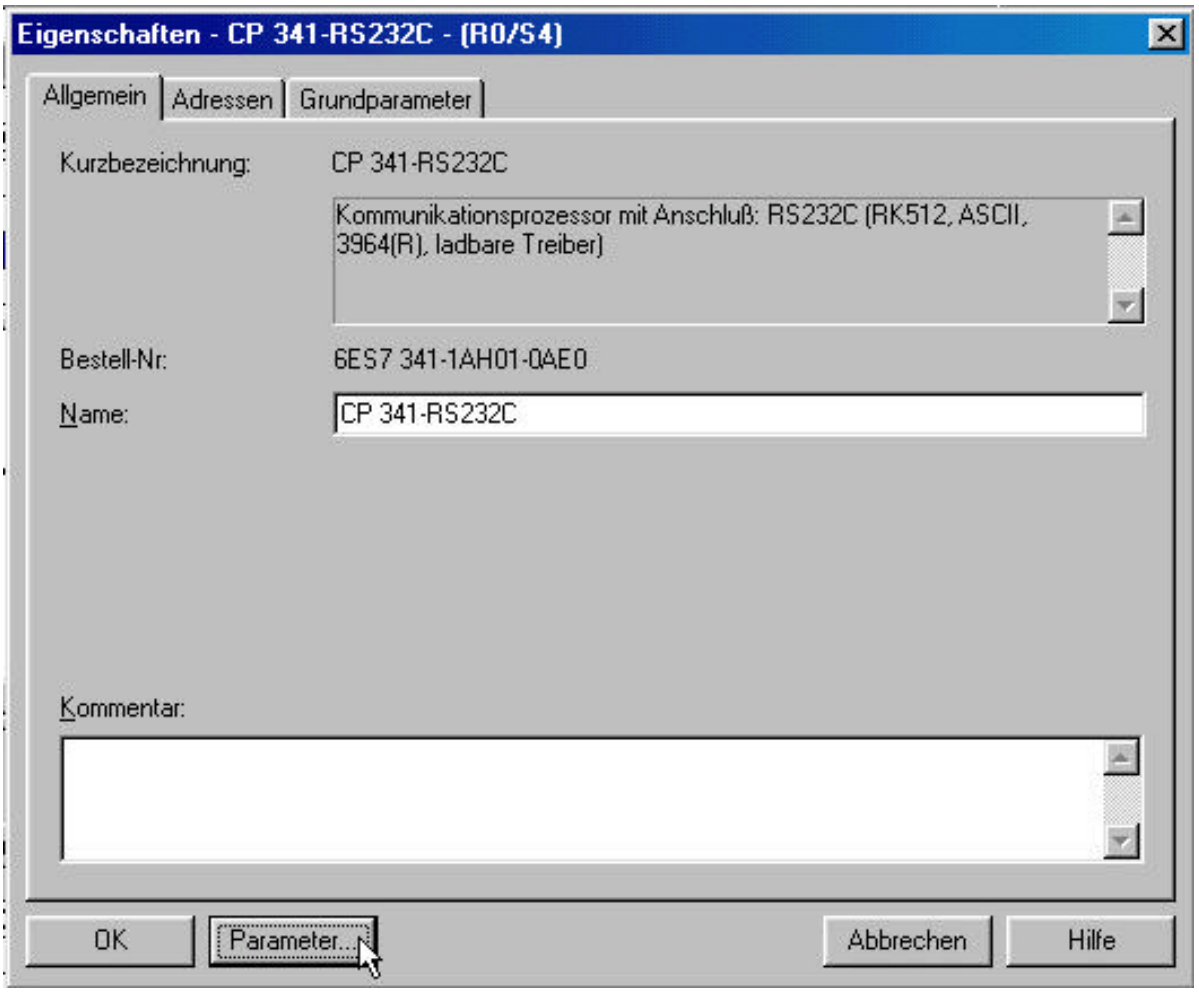
3.2.9.1 Basic Settings at the DATAEAGLE Communications Partner for the 3964R-Link:

- Baud rate: 1200,2400,4800,9600,19200,38400,57600,115200 Baud
- 8 data bits
- 1 stop bit
- Even parity
- Priority at the DATAEAGLE: High; at the CP 341: Low

3.2.9.2 Example of a CP 341 with 3964R Link (Step7 Hardware Configuration):

CP 341 properties:



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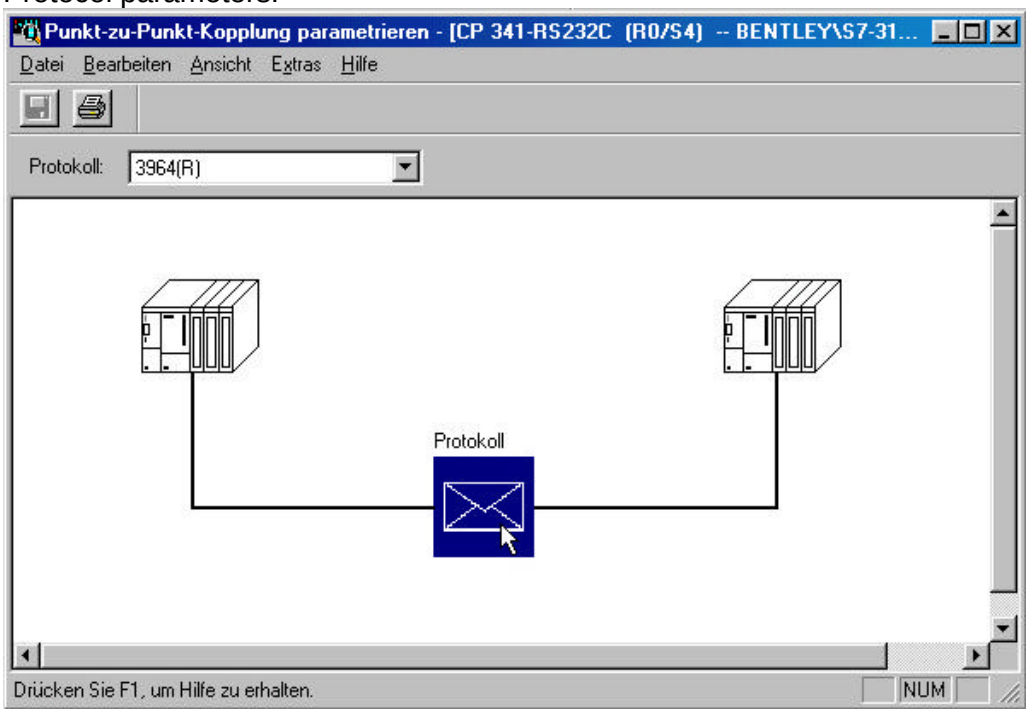
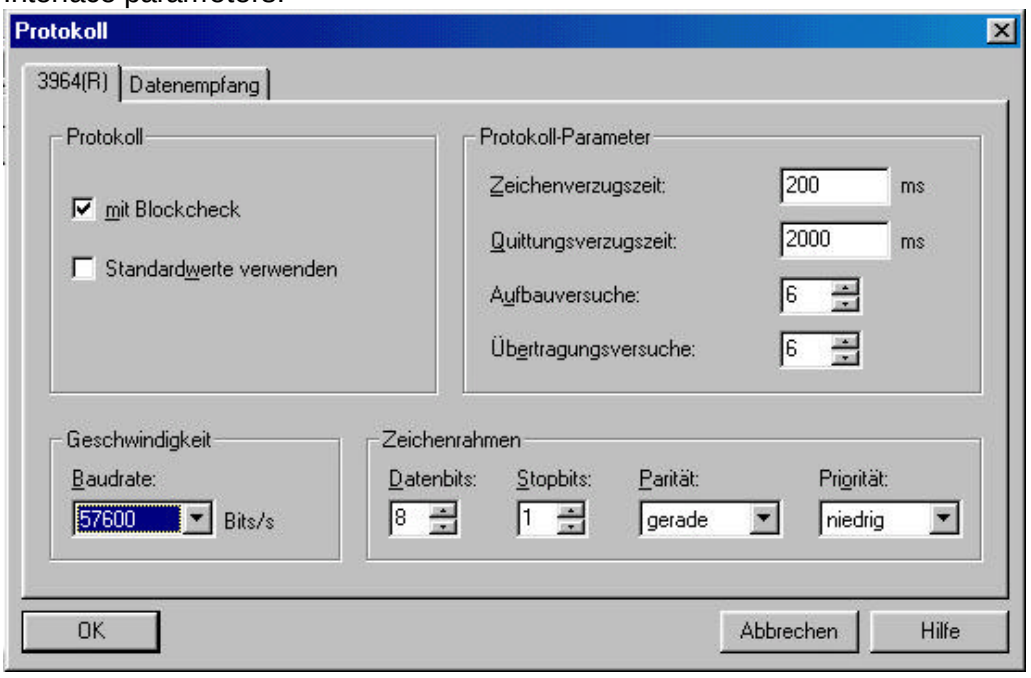
Protocol parameters:



Interface parameters:



Adjustable baud rates: Dependent on the settings in the DATAEAGLE ”Interface Driver” menu.
The DATAEAGLE operates on the serial interface to the CP341 with high priority. Therefore, the priority for the CP341 must be set to ”Low” here. With 3964R communications, the parameter of one subscriber must be set to high, the other to low.

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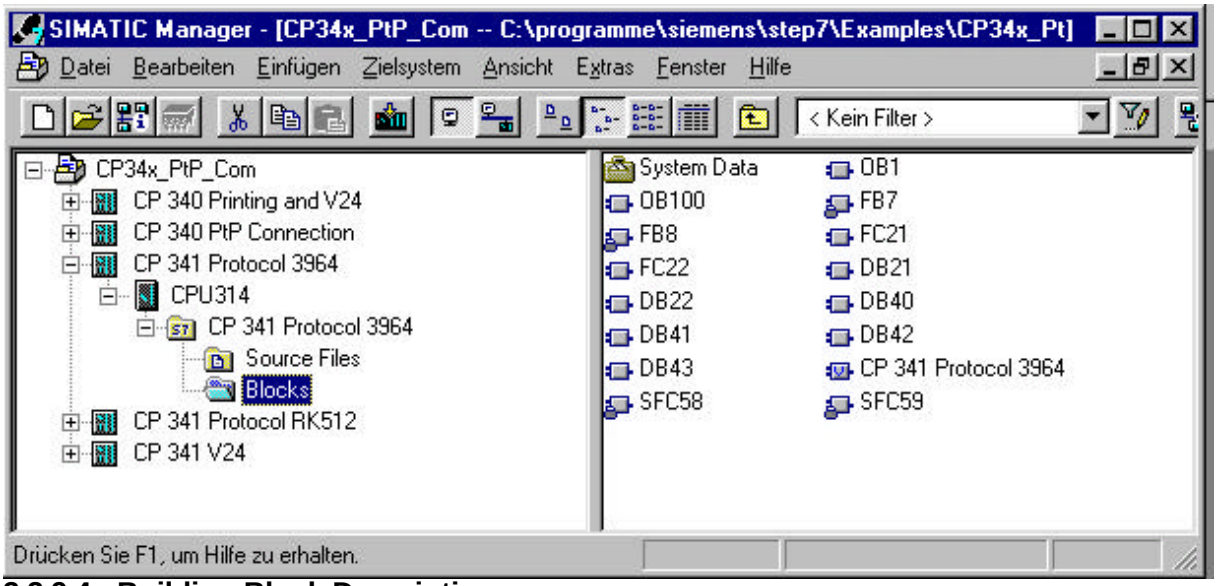
3.2.9.3 Step7 Example Project for the 3964R Link:

An S7 example project that is provided on the SIEMENS configuration CD for the CP 341 is used as the basis for the following project.



3.2.9.4 Building Block Description:

OB 1	:	Cycle program, calls up FC21 and FC22	
FC 21	:	“SEND” function	
FC 22	:	“RECV” function	
FB 7	:	Protected ”P_RCV_RK” function building block (receive)	
FB 8	:	Protected ”P_SND_RK” function building block (transmit)	
DB 21	:	“SEND_IDB” instance data building block for FB 8	
DB 22	:	“RECV_IDB” instance data building block for FB 7	
DB 40	:	“SEND_WORK_DB” work DB for FB 8	
DB 41	:	“RCV_WORK_DB” work DB for FB 7	
DB 42	:	Source DB for FB 8 ”P_SND_RK”	(DATAEAGLE transmit drawer)
DB 43	:	Target DB for FB 7 ”P_RCV_RK”	(DATAEAGLE receive drawer)

The transmit and receive drawer (data building block) structures are identical to the description in ”DE2000 SIEMENS S7 Link”.

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3.2.9.5 Setting the Building Block Parameters

The FC 21 and FC 22 functions must be modified for operation with the DATAEAGLE.

FC 21:

```
L    256                              //LADDR, base address of the CP 341 (HW config.)
T    “SEND WORK DB".P_SND_RK_WORK_LADDR

L    42                               //DB_NO, DB number of the transmit drawer
T    “SEND WORK DB".P_SND_RK_WORK_DB_NO
T    “SEND SRC DB".P_SND_RK_DB_NO

L    0                                //DBB_NO, Offset
T    “SEND WORK DB".P_SND_RK_WORK_DBB_NO
T    “SEND SRC DB".P_SND_RK_DBB_NO

L    200                              // Transmit drawer length, in bytes (make sure the length is adequate!)
T    “SEND WORK DB".P_SND_RK_WORK_LEN//LEN
T    “SEND SRC DB".P_SND_RK_LEN       //LEN

// ------------------------
// SEND with Instance-DB
// ------------------------
     CALL “P_SND_RK”,”SEND IDB"
      SF  :='S'
      REQ :="SEND WORK DB".P_SND_RK_REQ
      R   :="SEND WORK DB".P_SND_RK_R
      LADDR:="SEND WORK DB".P_SND_RK_WORK_LADDR
      DB_NO:="SEND WORK DB".P_SND_RK_WORK_DB_NO
      DBB_NO:="SEND WORK DB".P_SND_RK_WORK_DBB_NO
      LEN :="SEND WORK DB".P_SND_RK_WORK_LEN
      R_CPU_NO:=
      R_TYP:=
      R_NO:=
      R_OFFSET:=
      R_CF_BYT:=
      R_CF_BIT:=
      DONE:="SEND WORK DB".P_SND_RK_DONE
      ERROR:="SEND WORK DB".P_SND_RK_ERROR
      STATUS:="SEND WORK DB".P_SND_RK_WORK_STATUS
```


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```
// ------------------------
// Generate edge P_SND_RK_REQ
// ------------------------
```

Modification!

```
  //UN   “SEND WORK DB".P_SND_RK_REQ          //P_SND_RK_REQ
  //   S    “SEND WORK DB".P_SND_RK_REQ          //set P_SND_RK_REQ
```

DATAEAGLE accesses CP 341 independently. Therefore the transmit procedure is initiated after data receipt.

```
    O   “WORK_DB_REC”.P_RCV_RK_NDR          // If data are correctly received
    O   “WORK_DB_REC”.P_RCV_RK_ERROR  // or data are incorrectly re ceived,
    S   “WORK_DB_SEND”.P_SND_RK_REQ          // set transmit request




    O   “SEND WORK DB".P_SND_RK_DONE    //P_SND_RK_DONE
    O   “SEND WORK DB".P_SND_RK_ERROR    //P_SND_RK_ERROR
    R   “SEND WORK DB".P_SND_RK_REQ //P_SND_RK_REQ

// --------------------------------
// Check”Complete without error"
// --------------------------------
    UN   “SEND WORK DB".P_SND_RK_DONE       //check P_SND_RK_DONE
    SPB   CHER                                          //if P_SND_RK_DONE equals 0, jump to
CHER
                                                        //and check P_SND_RK_ERROR

// --------------------------------
//”Complete without error"
//  P_SND_RK_DONE = 1
// --------------------------------
    L   “SEND SRC DB".P_SND_RK_COUNTER_OK          //"Complete without Error"
    +    1                                                  //increment counter
    T   “SEND SRC DB".P_SND_RK_COUNTER_OK

    NOP   0
    NOP   0                    //further user functions
    NOP   0

    BE

// --------------------------------
// Check”Complete with error"
// P_SND_RK_ERROR = 1
// --------------------------------
CHER: UN   “SEND WORK DB".P_SND_RK_ERROR          //check P_SND_RK_ERROR
    BEB                                                 //if no error occurred, jump to end
```


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```
// --------------------------------
//”Complete with error"
// --------------------------------
    L   “SEND SRC DB".P_SND_RK_COUNTER_ERR        //"Complete with error"
    +    1                                        //increment counter
    T   “SEND SRC DB".P_SND_RK_COUNTER_ERR

    L   “SEND WORK DB".P_SND_RK_WORK_STATUS
    T   “SEND WORK DB".P_SND_RK_WORK_STATUS_SAV   //save STATUS

    NOP   0
    NOP   0                  //Error-Handling
    NOP   0

    BE
```

FC 22:

```
        L    256                                 //LADDR, base address of the CP 341 (HW config.)
        T   “RCV WORK DB".P_RCV_RK_WORK_LADDR

        L    43                                  //DB_NO, DB number of the receive drawer
        T   “RCV WORK DB".P_RCV_RK_WORK_DB_NO

        L    0                                   //DBB_NO, Offset
        T   “RCV WORK DB".P_RCV_RK_WORK_DBB_NO

// ------------------------
// Enable Receive Data
// ------------------------
    SET
    =   “RCV WORK DB".P_RCV_RK_EN_R //P_RCV_RK with P_RCV_RK_EN_R=TRUE

// ------------------------
// P_SND_RK with Instance-DB
// ------------------------
    CALL “P_RCV_RK”,”RECV IDB"
     EN_R:="RCV WORK DB".P_RCV_RK_EN_R
     R   :=
     LADDR:="RCV WORK DB".P_RCV_RK_WORK_LADDR
     DB_NO:="RCV WORK DB".P_RCV_RK_WORK_DB_NO
     DBB_NO:="RCV WORK DB".P_RCV_RK_WORK_DBB_NO
     L_TYP:=
     L_NO:=
     L_OFFSET:=
     L_CF_BYT:=
     L_CF_BIT:=
     NDR :="RCV WORK DB".P_RCV_RK_NDR
     ERROR:="RCV WORK DB".P_RCV_RK_ERROR
     LEN :="RCV WORK DB".P_RCV_RK_WORK_LEN
```


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```
      STATUS:="RCV WORK DB".P_RCV_RK_WORK_STATUS

// -------------------------------
// Check P_RCV_RK_NDR (Receive without error)
// -------------------------------
     UN   “RCV WORK DB".P_RCV_RK_NDR  //check P_RCV_RK_NDR
     SPB   CHER                  //if P_RCV_RK_NDR equals FALSE, jump to CHER
//and check P_RCV_RK_ERROR

// -------------------------------
//  P_RCV_RK_NDR = 1 (Receive without error)
// -------------------------------
     L    “RCV WORK DB".P_RCV_RK_WORK_CNT_OK    //"Receive without error"
     +    1                  //increment counter
     T    “RCV WORK DB".P_RCV_RK_WORK_CNT_OK

     L    “RCV WORK DB".P_RCV_RK_WORK_LEN    //save RECEIVE-Length
     T    “RCV WORK DB".P_RCV_RK_WORK_SAVE_LEN

     BE

// -------------------------------
// Check”Receive with error"
// -------------------------------
CHER: UN   “RCV WORK DB".P_RCV_RK_ERROR    //check P_RCV_RK_ERROR
     BEB                  //if no error occurred, jump to end

// -------------------------------
//”Receive with error"
// -------------------------------
     L    “RCV WORK DB".P_RCV_RK_WORK_CNT_ERR    //Error
     +    1                  //increment counter
     T    “RCV WORK DB".P_RCV_RK_WORK_CNT_ERR


// ----------------------------
// Save”P_RCV_RK_STATUS"
// ----------------------------
     L    “RCV WORK DB".P_RCV_RK_WORK_STATUS
     T    “RCV WORK DB".P_RCV_RK_WORK_STATUS_SAV    //save P_RCV_RK_STATUS
     BE
```


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3.2.10 Not used in English docu

3.2.11 Not used in English docu

3.2.12 Not used in English docu

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3.2.13 DE 2500/DE 2600, GSM/Telephone/Leased Line

With the DATAEAGLE DE 2500/2600 Series, controllers can be linked via analog modem, ISDN, and GSM telephoneconnections as well as 2-wire leased lines and party lines instead of via wireless connections. The device structure, operation, and functionality is compatible with the DE 2000 Series. The additionally required modem initialization and telephone dial sequence is transferred in the controller's data area.

Important notes:

- For GSM, data connection is required at the device that is to be called. Data connection can be confused with the GPRS service. GPRS is a package-oriented transmission. One of the most common causes of errors is the fact that the SIM card does not have this data connection. In this case, the DATAEAGLE will not accept the call.

- The call can be dialed from the DE master and the DE slave.

- The lengths of the transmit and receive drawers must be specified in the transmit drawer at the DE slave (this is not required with the DE2000).

- Redialing and disconnection are only possible by a change to the modem control byte, that is, redialing is only possible after disconnection and vice versa!

3.2.13.1 Transmit DB Structure

Master transmit drawer	Function
DBB0	Order number
DBB1	Partner address
DBB2	No. of utility data bytes in the receive drawer, starting at DBB4
DBB3	No. of utility data bytes in the transmit drawer, starting at DBB4
DBB4	1st utility data byte
...	...
DBBn	Last utility data byte
DBBn+1	0
DBBn+2	0 [12]
DBBn+3	Modem control byte 0...Modem disconnect 1...Modem connect + data transmission after connect 2...Modem reset + base settings 3...Transmit PIN number
DBBn+4	Connection sequence, e.g., atdt3
...	...
	0x0D (end of connection sequence)

[12] Additional subscribers can follow here.

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3.2.13.2 Receive DB Structure

Master receive drawer	Function
DBB0	Order number
DBB1	Partner address
DBB2	No. of utility data bytes in the receive drawer, starting at DBB4
DBB3	No. of utility data bytes in the transmit drawer, starting at DBB4
DBB4	1st utility data byte
...	...
DBBn	Last utility data byte
DBBn+1	0
DBBn+2	0 [13]
DBBn+3	Modem status 0x30 ok 0x31 Connect 0x32 Ring 0x33 Busy, No Dial tone or No Carrier >0x33 General errors -> Modem command byte = 2

3.2.13.3 Example with an S7-312 IFM:

- DATAEAGLE master (DE master) is the caller (originate), with a subscriber address of 01 and the telephone number ”2”.
- DATAEAGLE slave (DE slave) is the receiver (answer) with a subscriber address of 02 and the telephone number ”3”
- The modem connection corresponds to the dial sequence using AT Hayes commands described in every modem manual.

Example of a connection procedure with dial tone connection, without an exchange. (Telephone 0711 1234567)
Connection sequence starting at DBB11: a t d t 0 7 1 1 1 2 3 4 5 6 7 0D (hex)

Example of a connection procedure with pulse tone dialing, without an exchange. (0711 1234567)
Connection sequence starting at DBB11: a t d p 0 7 1 1 1 2 3 4 5 6 7 0D (hex)

[13] L1 length = (number of slaves * (number of utility data bytes per slave + 4)) + 2

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3.2.13.4 Basic Conditions Prior to a Data Transmission

There are, as yet, no data in the receive drawer. The telephone number is specified, starting at DBB57.

Operand	Statusformat	Statuswert	Steuerwert
// Sendefach			
DB3.DBW 0	HEX	W#16#0102	W#16#0102
DB3.DBW 2	HEX	W#16#2E2E	W#16#2E2E
DB3.DBW 4	HEX	W#16#1122	W#16#1122
// Ende der Teilnehmerliste			
DB3.DBW 50	HEX	W#16#0000	W#16#0000
// Modem Kommandobyte			
DB3.DBB 52	HEX	B#16#00	B#16#00
// Anwahlsequenz			
DB3.DBB 53	ZEICHEN	'a'	'a'
DB3.DBB 54	ZEICHEN	't'	't'
DB3.DBB 55	ZEICHEN	'd'	'd'
DB3.DBB 56	ZEICHEN	't'	't'
DB3.DBB 57	ZEICHEN	'3'	'3'
DB3.DBB 58	HEX	B#16#0D	B#16#0D
// Empfangsfach			
DB4.DBW 0	HEX	W#16#0000	
DB4.DBW 2	HEX	W#16#0000	
DB4.DBW 4	HEX	W#16#0000	
// Modemstatus			
DB4.DBB 52	ZEICHEN	'0'	

3.2.13.5 Modem Control Byte:

01	Connect
00	Disconnect
03	PIN number

The PIN number is transmitted as follows:

DB3.DBB52	3
DB3.DBB53	1st PIN character
DB3.DBB54	2nd PIN character
DB3.DBB55	3rd PIN character
DB3.DBB56	4th PIN character
DB3.DBB57	$r = HEX 0D

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3.2.13.6 Connection by the DE Master

The modem control byte becomes 1 and initiates the connection sequence. If there are no problems establishing the telephone connection, the DE master indicates a connect status (1) in the modem status byte, while the DE slave of the device called reports a ring status (2). If the telephone line is busy or the connection cannot be established, the error status (3) is indicated in the caller's modem status byte. The modem control byte must be reset to 0 (disconnect) in order for the modem to be able to redial. The DE on the device being called independently accepts the call and reports the connection by also setting a connect message in the modem status byte.

Operand	Statusformat	Statuswert	Steuerwert
// Sendefach			
DB3.DBW 0	HEX	W#16#0102	W#16#0102
DB3.DBW 2	HEX	W#16#2E2E	W#16#2E2E
DB3.DBW 4	HEX	W#16#1122	W#16#1122
// Ende der Teilnehmerliste			
DB3.DBW 50	HEX	W#16#0000	W#16#0000
// Modem Kommandobyte			
DB3.DBB 52	HEX	B#16#01	B#16#01
// Anwahlsequenz			
DB3.DBB 53	ZEICHEN	'a'	'a'
DB3.DBB 54	ZEICHEN	't'	't'
DB3.DBB 55	ZEICHEN	'd'	'd'
DB3.DBB 56	ZEICHEN	't'	't'
DB3.DBB 57	ZEICHEN	'3'	'3'
DB3.DBB 58	HEX	B#16#0D	B#16#0D
// Empfangsfach			
DB4.DBW 0	HEX	W#16#0202	
DB4.DBW 2	HEX	W#16#2E2E	
DB4.DBW 4	HEX	W#16#	
// Modemstatus			
DB4.DBB 52	ZEICHEN	'1'	

Modem control byte = 1 for connection

"CONNECT"

"CONNECT" takes place after several seconds.

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3.2.13.7 Situation if the Partner is Busy

If the partner is busy, the modem status byte is ”3”.

Operand	Statusformat	Statuswert	Steuerwert
// Sendefach			
DB3.DBW 0	HEX	W#16#0102	W#16#0102
DB3.DBW 2	HEX	W#16#2E2E	W#16#2E2E
DB3.DBW 4	HEX	W#16#1122	W#16#1122
// Ende der Teilnehmerliste			
DB3.DBW 50	HEX	W#16#0000	W#16#0000
// Modem Kommandobyte			
DB3.DBB 52	HEX	B#16#01	B#16#01
// Anwahlsequenz			
DB3.DBB 53	ZEICHEN	'a'	'a'
DB3.DBB 54	ZEICHEN	't'	't'
DB3.DBB 55	ZEICHEN	'd'	'd'
DB3.DBB 56	ZEICHEN	't'	't'
DB3.DBB 57	ZEICHEN	'3'	'3'
DB3.DBB 58	HEX	B#16#0D	B#16#0D
// Empfangsfach			
DB4.DBW 0	HEX	W#16#0000	
DB4.DBW 2	HEX	W#16#0000	
DB4.DBW 4	HEX	W#16#0000	
// Modem Statusbyte			
DB4.DBB 52	ZEICHEN	'3'	

If the connection is busy, ““BUSY” message is generated.

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3.2.13.8 Disconnection by the DE Master

At the completion of the transmission disconnection is made at the DE master by modem control byte = 0. As a check, both modem status bytes = 0 or both report ”No Carrier”.

Operand	Statusformat	Statuswert	Steuerwert
// Sendefach			
DB3.DBW 0	HEX	W#16#0102	W#16#0102
DB3.DBW 2	HEX	W#16#2E2E	W#16#2E2E
DB3.DBW 4	HEX	W#16#1122	W#16#1122
// Ende der Teilnehmerliste			
DB3.DBW 50	HEX	W#16#0000	W#16#0000
// Modem Kommandobyte			
DB3.DBB 52	HEX	B#16#00	B#16#00
// Anwahlsequenz			
DB3.DBB 53	ZEICHEN	'a'	'a'
DB3.DBB 54	ZEICHEN	't'	't'
DB3.DBB 55	ZEICHEN	'd'	'd'
DB3.DBB 56	ZEICHEN	't'	't'
DB3.DBB 57	ZEICHEN	'3'	'3'
DB3.DBB 58	HEX	B#16#0D	B#16#0D
// Empfangsfach			
DB4.DBW 0	HEX	W#16#0202	
DB4.DBW 2	HEX	W#16#2E2E	
DB4.DBW 4	HEX	W#16#1122	
// Modem Statusbyte			
DB4.DBB 52	ZEICHEN	'0'	

Disconnect by modem command byte=0

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3.2.13.9 Example for Multiple Slaves:

Operand	Statusformat	Statuswert	Steuerwert
// Sendefach			
// Teilnehmer Adresse 3			
DB3.DBW 0	HEX	W#16#0103	W#16#0103
DB3.DBW 2	HEX	W#16#2E2E	W#16#2E2E
DB3.DBW 4	HEX	W#16#1122	W#16#1122
// Teilnehmer Adresse 2			
DB3.DBW 50	HEX	W#16#0502	W#16#0502
DB3.DBW 52	HEX	W#16#2E2E	W#16#2E2E
DB3.DBW 54	HEX	W#16#6644	W#16#6644
// Ende der Teilnehmerliste			
DB3.DBW 100	HEX	W#16#0000	W#16#0000
// Modem Kommandobyte			
DB3.DBB 102	HEX	B#16#00	B#16#00
// Anwahlsequenz			
DB3.DBB 103	ZEICHEN	'a'	'a'
DB3.DBB 104	ZEICHEN	't'	't'
DB3.DBB 105	ZEICHEN	'd'	'd'
DB3.DBB 106	ZEICHEN	't'	't'
DB3.DBB 107	ZEICHEN	'3'	'3'
DB3.DBB 108	HEX	B#16#0D	B#16#0D
// Empfangsfach			
DB4.DBW 0	HEX	W#16#0000	
DB4.DBW 2	HEX	W#16#0000	
DB4.DBW 4	HEX	W#16#0000	
DB4.DBW 50	HEX	W#16#0602	
DB4.DBW 52	HEX	W#16#2E2E	
DB4.DBW 54	HEX	W#16#6644	
// Modem Statusbyte			
DB4.DBB 102	ZEICHEN	'0'	

Data are only exchanged with the connected partner.

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3.2.13.10 Important Information:

- The call can be dialed from the DE master and the DE slave.
- The lengths of the transmit and receive drawers must be specified in the transmit drawer at the DE slave (this is not required with the DE2000).
- Redialing and disconnection are only possible by a change to the modem control byte, that is, redialing is only possible after disconnection and vice versa!
- Disconnection at the called DATAEAGLE occurs approx. 1 minute after the caller hangs up.
- This is also the timeout period, after which the DATAEAGLE hangs up if no modem data are received, even if the connection is established! (Protection against continuous use!)
- The “0x03” command byte sends the PIN number to the DATAEAGLE once after power up.

- A SIM card that permits incoming data calls is required for data transmission (not GPRS!!!). Normally the provider supplies an own telephone number for this.

- For security reasons, the SIM card holder is located inside the device.
  The device must be opened to install the SIM card.
  To do this, switch the unit off, remove the two hex-head screws (on the right side of the display) and the two Philips head screws (on the left side of the power supply), then carefully push the PCB out towards the left.
  Attention: Be careful when disconnecting the keypad wire.
  After installing the SIM card, insert the PCB in the correct guide, push it into the unit, and reconnect the keypad.
  Reinstall and tighten all screws.

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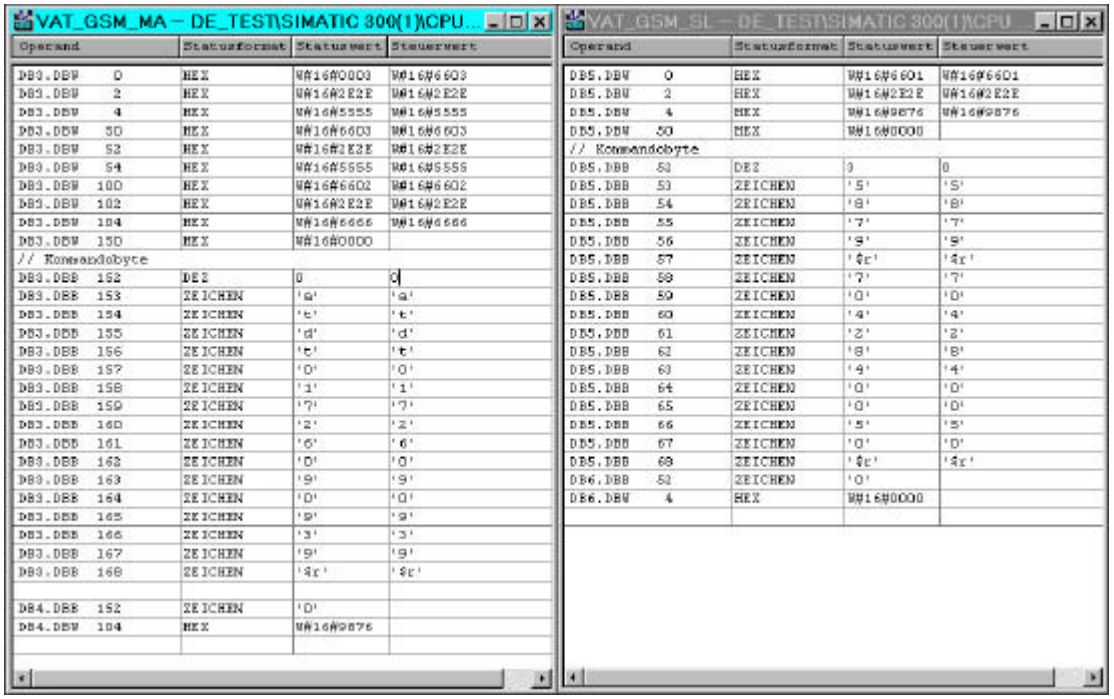
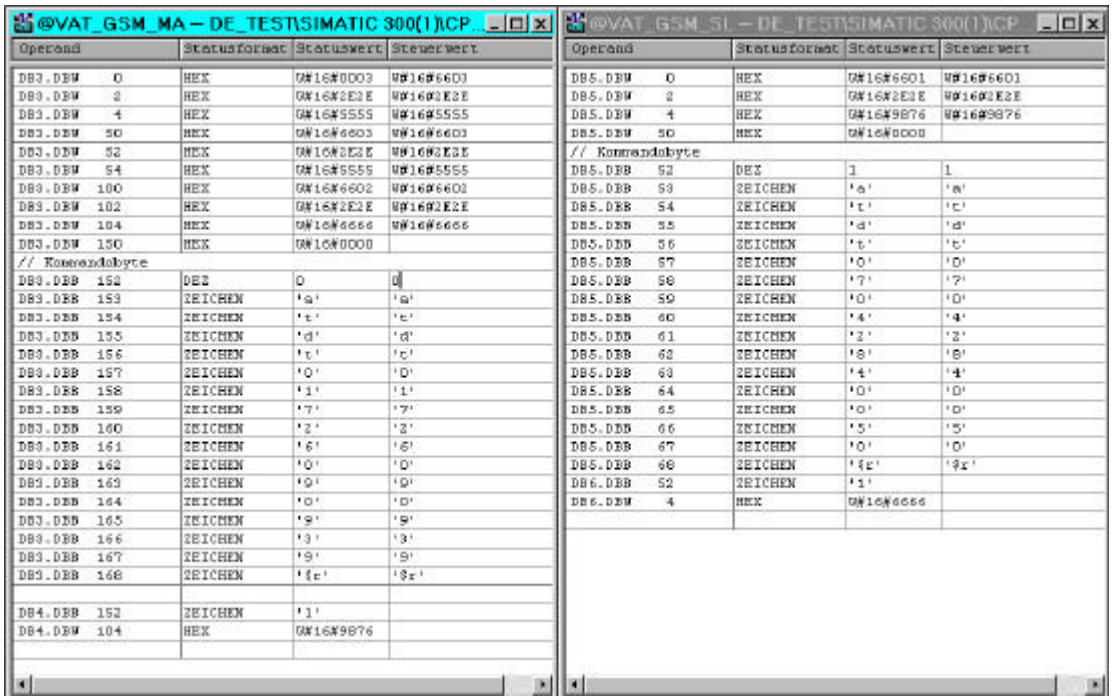
3.2.13.11 Example of Status Variables with an S7 for Both DATAEAGLEs

3.2.13.11.1 PIN Transfer



3.2.13.11.2 Connect After Establishing Link



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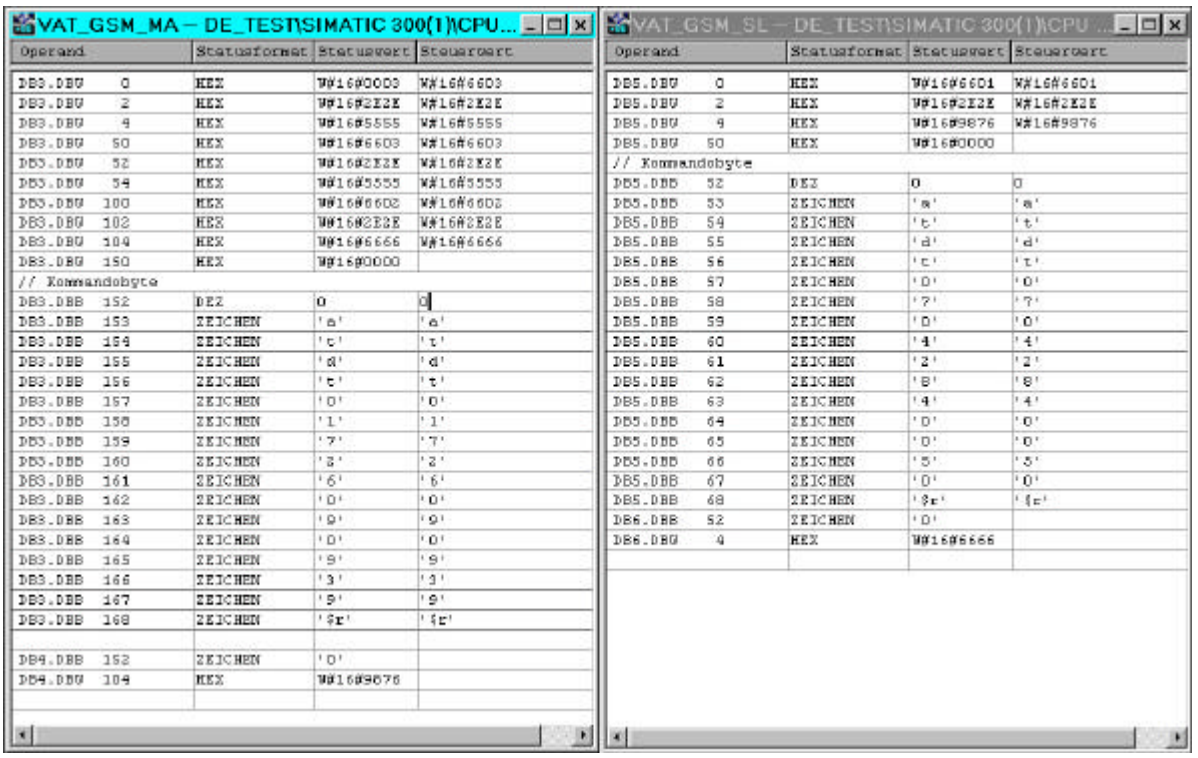
3.2.13.11.3 Disconnection



3.2.13.11.4 Example for S7-200

	Adresse	Format	Aktueller Wert	Neuer Wert
1	VW0	Hexadezimal	16#2202	// Auftragszähler, Zieladresse
2	VW2	Hexadezimal	16#2E2E	// Längen der Fächer
3	VW4	Hexadezimal	16#1234	// Nettodaten...
4		Mit Vorzeichen		
5	VW50	Ohne Vorzeich	0	// Ende der Liste
6	VB52	Ohne Vorzeich	0	// Kommandobyte Modem
7	VB53	ASCII	'a'	// Sequenz
8	VB54	ASCII	't'	
9	VB55	ASCII	'd'	
10	VB56	ASCII	't'	
11	VB57	ASCII	'0'	
12	VB58	ASCII	'1'	
13	VB59	ASCII	'7'	
14	VB60	ASCII	'4'	
15	VB61	ASCII	'3'	
16	VB62	ASCII	'4'	
17	VB63	ASCII	'5'	
18	VB64	ASCII	'0'	
19	VB65	ASCII	'9'	
20	VB66	ASCII	'1'	
21	VB67	ASCII	'6'	
22	VB68	Hexadezimal	16#0D	// Sequenzende
23		Mit Vorzeichen		
24		Mit Vorzeichen		

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3.3 DATAEAGLE WOPY, Wireless Operator Panel

We integrated the electronics of the DATAEAGLE DE2100 into a compact housing, then added wireless technology, a battery, and an expandable keyboard. In this housing form, we call the result the DATAEAGLE WOPY Series.

With respect to its software structure, the DE WOPY is a DE 2100, however, one which does not have a PLC link, but instead displays the received characters from the transmit drawer on the screen and which writes each keystroke to the central controller's receive drawer. The DE WOPY can, however, also be integrated in a DATAEAGLE DE 2100 network as a normal SLAVE.

DATAEAGLE OP comes with built-in batteries to provide fully mobile application. For power consumption reasons, only a combination in the DE 2100 DECT is currently practical. Depending on the battery storage capacity, operating periods of 12 hours or more are possible. The WOPY is available with a 2 x 16 character or a 4 x 16 character display. (The figure shows the 4 x 16 display.)

The figure above shows the required components: S7 with DATAEAGLE DE2100 and WOPY

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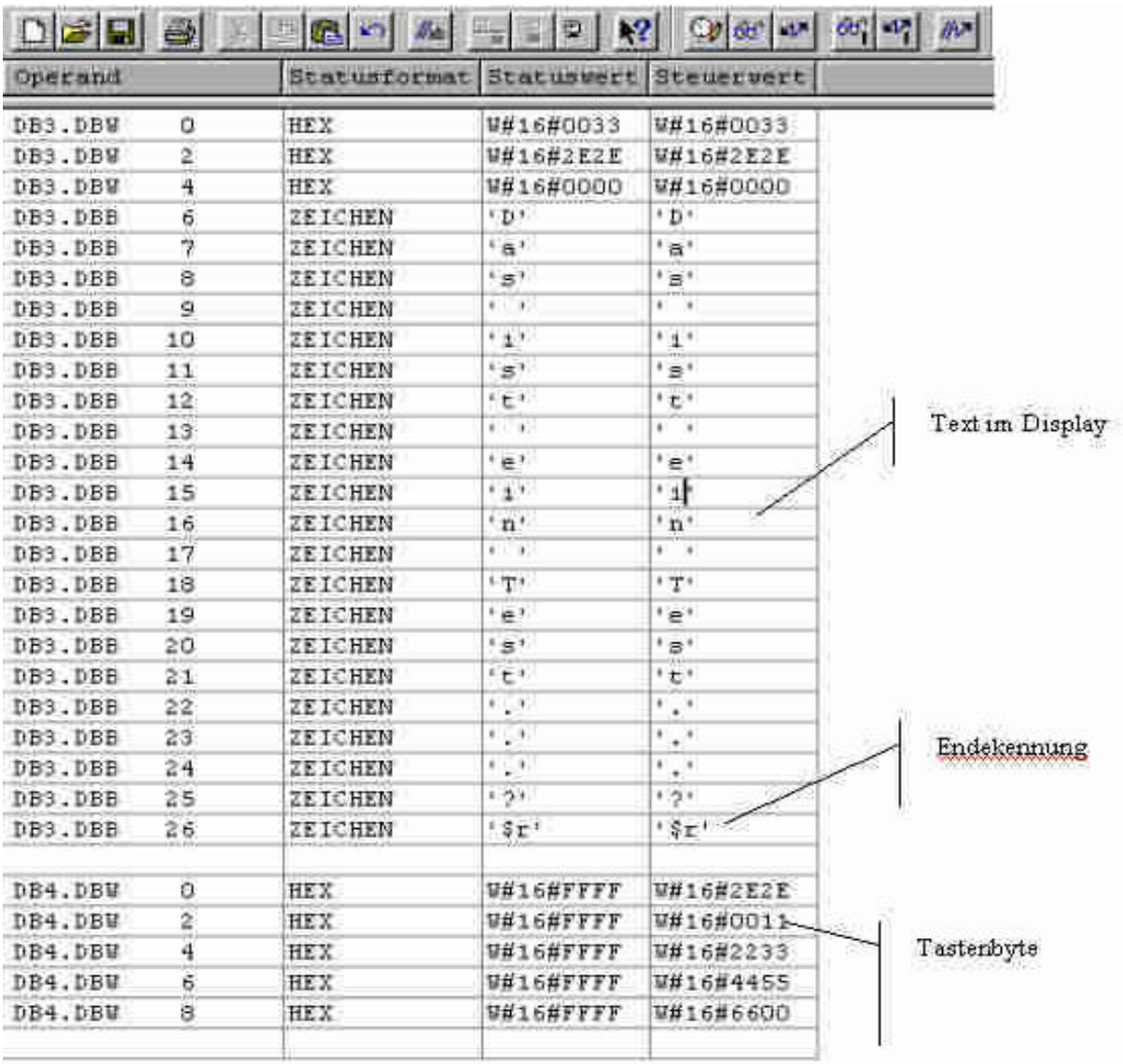
3.3.1 Text Output via Data Building Blocks to the Display



Operand		Statusformat	Statuswert	Steuerwert
DB3.DBW	0	HEX	W#16#0033	W#16#0033
DB3.DBW	2	HEX	W#16#2E2E	W#16#2E2E
DB3.DBW	4	HEX	W#16#0000	W#16#0000
DB3.DBB	6	ZEICHEN	'D'	'D'
DB3.DBB	7	ZEICHEN	'a'	'a'
DB3.DBB	8	ZEICHEN	's'	's'
DB3.DBB	9	ZEICHEN	' '	' '
DB3.DBB	10	ZEICHEN	'i'	'i'
DB3.DBB	11	ZEICHEN	's'	's'
DB3.DBB	12	ZEICHEN	't'	't'
DB3.DBB	13	ZEICHEN	' '	' '
DB3.DBB	14	ZEICHEN	'e'	'e'
DB3.DBB	15	ZEICHEN	'i'	'i'
DB3.DBB	16	ZEICHEN	'n'	'n'
DB3.DBB	17	ZEICHEN	' '	' '
DB3.DBB	18	ZEICHEN	'T'	'T'
DB3.DBB	19	ZEICHEN	'e'	'e'
DB3.DBB	20	ZEICHEN	's'	's'
DB3.DBB	21	ZEICHEN	't'	't'
DB3.DBB	22	ZEICHEN	'.'	'.'
DB3.DBB	23	ZEICHEN	'.'	'.'
DB3.DBB	24	ZEICHEN	'.'	'.'
DB3.DBB	25	ZEICHEN	'?'	'?'
DB3.DBB	26	ZEICHEN	'$r'	'$r'
DB4.DBW	0	HEX	W#16#FFFF	W#16#2E2E
DB4.DBW	2	HEX	W#16#FFFF	W#16#0011
DB4.DBW	4	HEX	W#16#FFFF	W#16#2233
DB4.DBW	6	HEX	W#16#FFFF	W#16#4455
DB4.DBW	8	HEX	W#16#FFFF	W#16#6600

The display text is output to the data building block (in this example, starting at DBB 6). All ASCII characters can be displayed. The character combination ”$r” is used as the end identifier for the ASCII text in the DB (corresponds to the Step 7 indicator =Hex OD).

3.3.2 Keyboard Input

A keystroke sends a corresponding key code to the PLC, together with a strobe and toggle bit to signal a keystroke.

Key byte: (first net word)

High byte: Bit 0 is a toggle bit that toggles with each keystroke.
Bit 1 is the strobe bit, that is, it is 1 when the key is pressed.
Low byte: Key information bit indicating which key has been pressed.

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3.3.3 Multiple Cell Operation

DE WOPY can be integrated in a DATAEAGLE DE2100 network as desired in order to implement multiple cell operation. A practical example of such an application would be when maintaining a link to a machine on each floor of a multi-story factory facility.

For example, one WOPY can be located in the basement and on the top floor, each in its own wireless cell with the S7.

Multiple cell operation with several DATAEAGLE WOPY units. Both units log onto the transmitter that offers the best reception. This cell switchover is performed automatically.

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3.3.4 DATAEAGLE WOPY Power Supply

DATAEAGLE WOPY operates with standard NiMH batteries.

Using 3 x AA NiMH 2200mA batteries, the unit can operate for 12 hours.

External charger for the DATAEAGLE WOPY

The DE WOPY is switched on and off with a switch next to the recharge connector socket.

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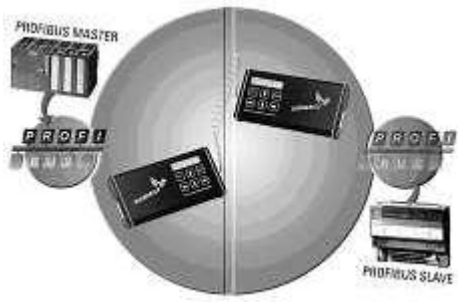
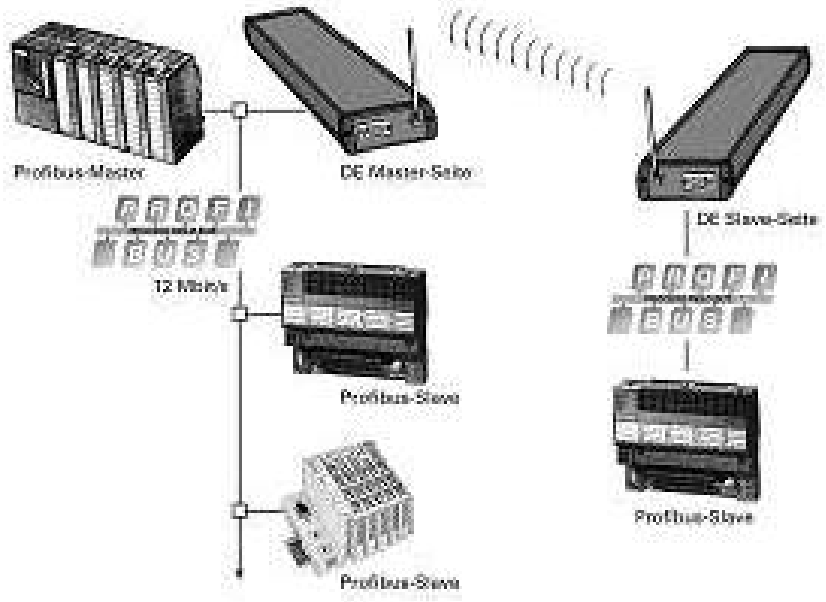
3.4 DE 3000 Family Functional Description



3.4.1 DE 3000

Using the DATAEAGLE DE 3000, one! remote Profibus standard slave can be connected to a master via a wireless link. In our example, we will use the linking of a SIEMENS ET200 assembly to the SIEMENS S7 Profibus master interface. On the Profibus master side, the DE 3000 can be linked to the bus with up to 12 MB Profibus speed.

Intended applications are areas where a link to rotating or moving systems is to be established and examples include cranes, conveyor vehicles in warehouses, moving robots, rotating bridges over settling ponds in water treatment facilities. DE 3000 is used where mobile equipment does not have its own controller. If two controllers are to be linked (e.g., SIEMENS S7), we recommend using the DE 2000 family.



DE 3000 application: Wireless link to a DP slave

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3.4.1.1 DE 3000 PROFIBUS DP Interface Technical Specifications

DE3000 master side

Profibus speed:	9600 – 12 MB
Interface:	Standard RS485 Profibus
Wireless signal delay:	20 ms
Address setting:	1-99 via keyboard

DE3000 slave side

Number of Profibus subscribers:	1
Interface:	Standard RS485 Profibus
Connection options:	All standard slaves

3.4.1.2 DE 3000 Family, Commissioning

Two different DATAEAGLEs are required for wireless transmission: The ”DATAEAGLE master side” assumes the role of the actual Profibus slave (target) in the DP network. Data are sent to the DATAEAGLE partner, the ”DATAEAGLE slave side”, via wireless transmission. The latter then assumes responsibility for activating the target.

The wireless connection is not transparent to the Profibus master and the target.
The parameters of the DE 3000 are factory set so that only the slave address for the target must still be specified on the display.

Attention, definition! (refer also to ”Terminology Used”)

The DATAEAGLE connected to the DP master via a Profibus cable is referred to as the DATAEAGLE master side.
The DATAEAGLE connected to the slave is referred to as the DATAEAGLE slave side.

If several DP slaves are to be connected after the wireless transmission path, a DE 3001 must be used. The maximum Profibus speed of a DE 3001 is 93.75 KB.

3.4.1.3 Operating Principle

The DE 3000 master side includes the Profibus / DP slave interface and is therefore integrated directly into the existing Profibus network. It uses a cable connection to communicate with the actual DP master (e.g., Siemens S7).
At the opposite end of the transmission path, the DE 3000 slave side activates the DP slaves.

3.4.1.4 Profibus Address Parameter Settings:

The address of the DP slave must be specified on the DE 3000 master side. A master address is also assigned here. The DE 3000 on the slave side uses this latter address to communicate with the connected DP slave. Most practically, the master address is the address of the actual DP master, although it does not need to be.

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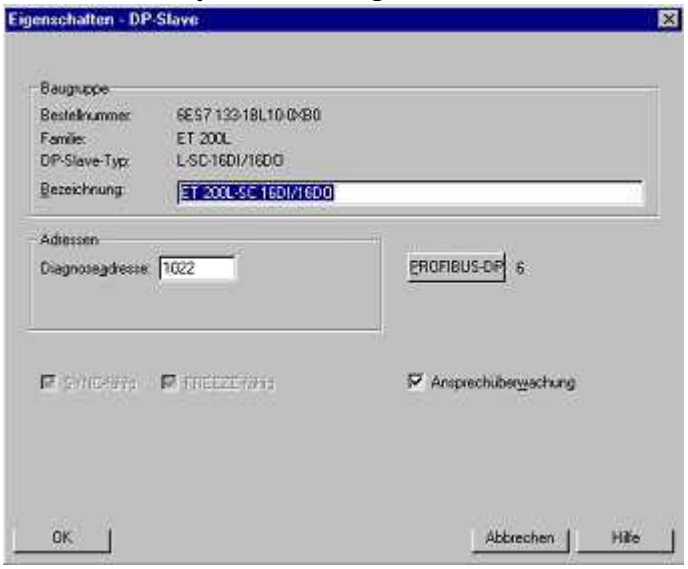
3.4.1.5 DE 3000 Master Side Parameter Settings

- Switch the DE3000 master side on.
- Use "🡐" or "➔" to enter the password menu.
- Using the arrow keys, set the password (default value = "00") and confirm with "ENTER".
- Use "➔" to switch to the "Change Interface Driver" menu. (ENTER)
- Driver: Transparent (ENTER)
- Parameter for: Profibus Bridge (ENTER)
- Master side (ENTER)
- SA.: (DP salve address), MA.: (Profibus master address) (ENTER)
- Use "ESC" to return to the base menu.

3.4.1.6 DE 3000 Slave Side Parameter Settings

Same procedure as for the master side, except use "🡑" or "🡓" to change "Master side" to "Slave side". No other settings are required.

3.4.1.7 Example of Linking ET200 to S7 315 DP



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3.4.1.8 DE 3000 List of Authorized Third-Party Devices

In principle, all Profibus DP slaves can be activated by wireless transmission.
To date, we have tested and released the following Profibus slaves.

SIEMENS ET200L- SC (16 I/O)	6ES7 133-1BL10- 0XB0
SIEMENS ET200S	Test at Siemens, Mannheim
SIEMENS SIMATIC S5-95U	6ES5 095- 8MD03
DEUTSCHMANN UNIGATE	
LÜTZE DIOCOM DC-PB-CMDI-8	SW: 1.09 PB-DP 2.00 LPM
LÜTZE DIOCOM DC-PB-CMDO-8	SW: 1.09 PB-DP 2.00 LPM

SCHILDKNECHT display and operator unit, large format displays of the HANDY Family

WAGO I/O System
Communications have been tested for the following bus couplers:
750-301
750-303
750-323
These bus couplers have been tested with the following terminal types (if they can be used at the bus coupler):

750-400	750-501	750-452	750-550	750-404
750-401	750-502	750-454	750-552	750-650
750-402	750-504	750-456	750-554	
750-403	750-512	750-461	750-556	
750-405	750-513	750-467		
750-406		750-468		
750-410		750-480		
750-411		750-481		

(Tested and released by Wago)

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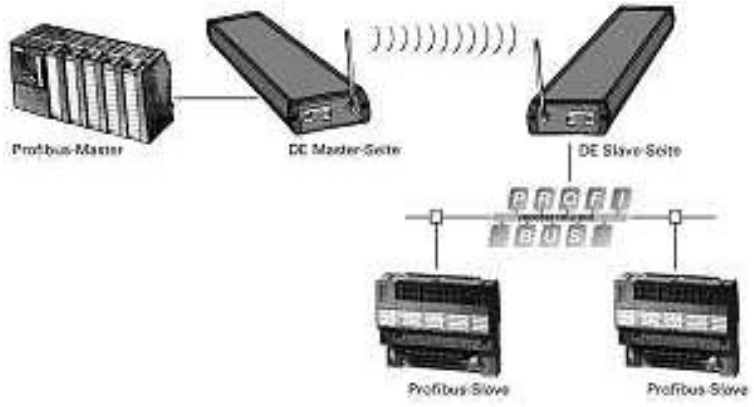
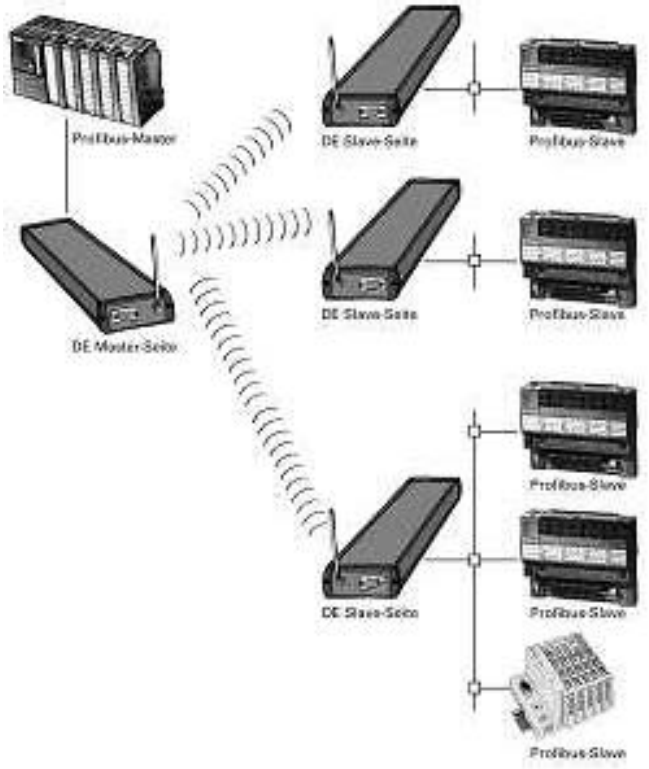
3.4.2 DE 3001

The DATAEAGLE DE 3001 can be used to establish a wireless link between multiple Profibus slave modules and a master. The Profibus speed is 93.75 KB and no additional subscriber is permitted on the DE master side. In other words, one Profibus strand is required solely for the DATAEAGLE. The Profibus DP T-Slot time must be adjusted in the controller (refer to “DE 3001 Commissioning”)

The DE 3001 transfers the Profibus transparently across the wireless transmission path. This allows all DP slaves to be used.



DE 3001 application: Multiple DP slaves after the wireless transmission path



DE 3001 application: Multiple DP slaves after the wireless transmission path

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3.4.2.1 DE 3001 PROFIBUS DP Interface Technical Data

DE3001 master side

Profibus speed:	Up to 187.5 KB, automatic baud rate recognition
Interface:	Standard RS485 Profibus
Wireless signal delay:	100 ms
Profibus address setting:	At the Profibus slave

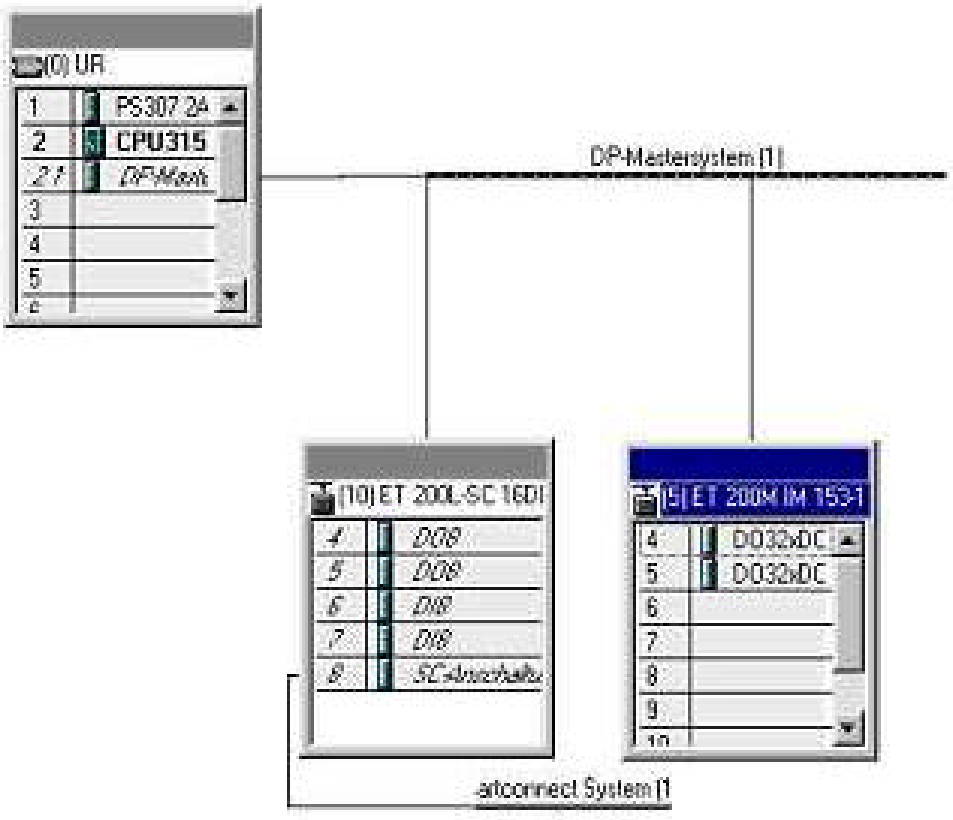
DE3001 slave side

Number of Profibus subscribers:	According to the Profibus definition
Interface:	Standard RS485 Profibus
Connection options:	All standard slaves

3.4.2.2 DE 3001 Commissioning

In order to start the DE3001, the T_{slot} time must be modified using the following steps.

Go to the hardware configuration under Step 7 and select the DP master.



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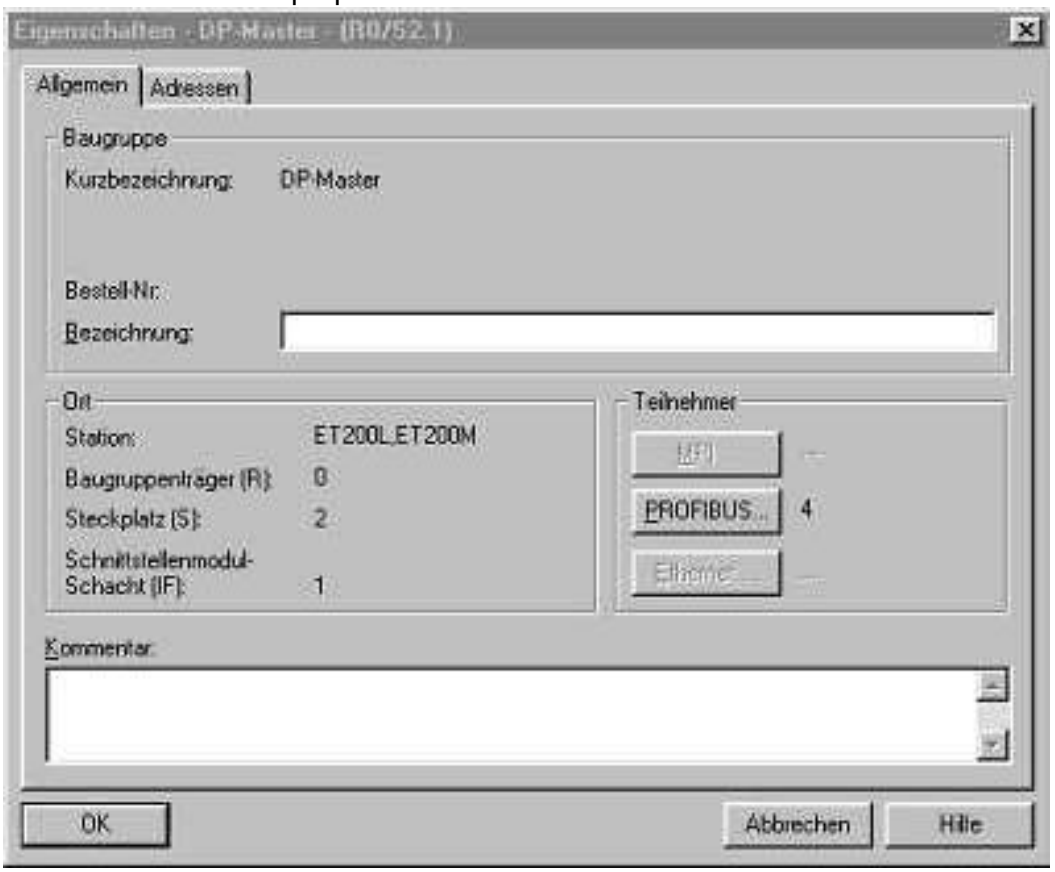
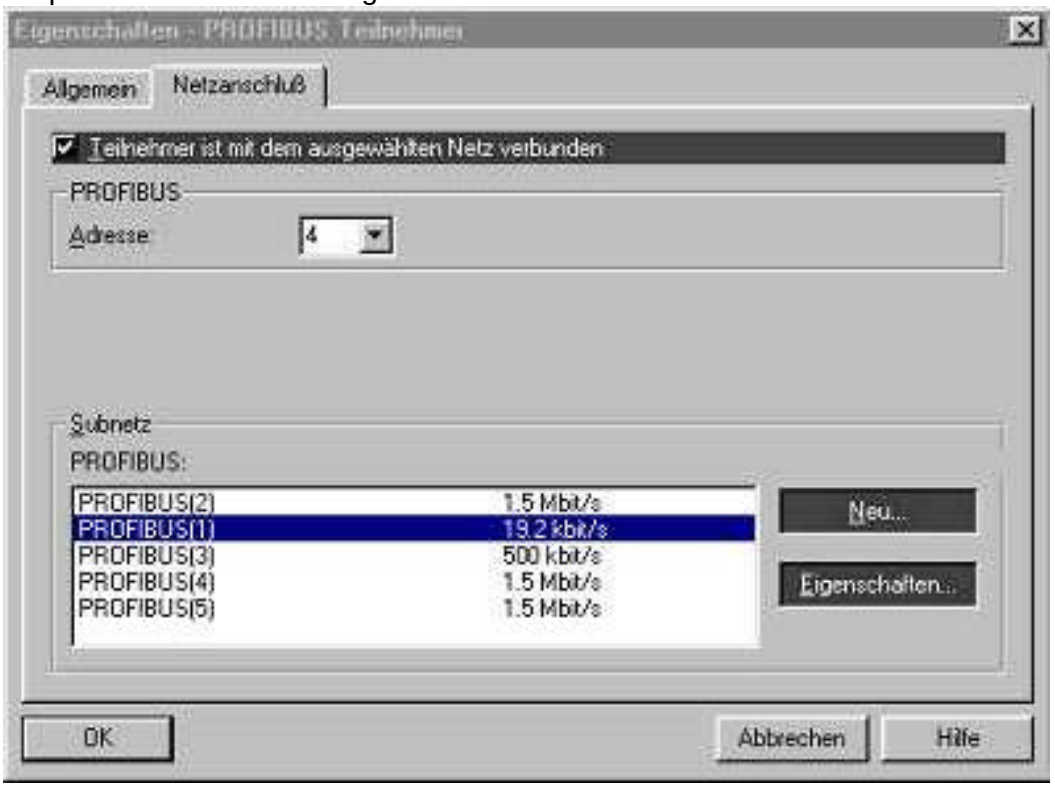
Select the DP master properties.



Under “Properties”, select ”Profibus Network Connection Subscriber”.
Properties – Network Settings – Bus Parameters



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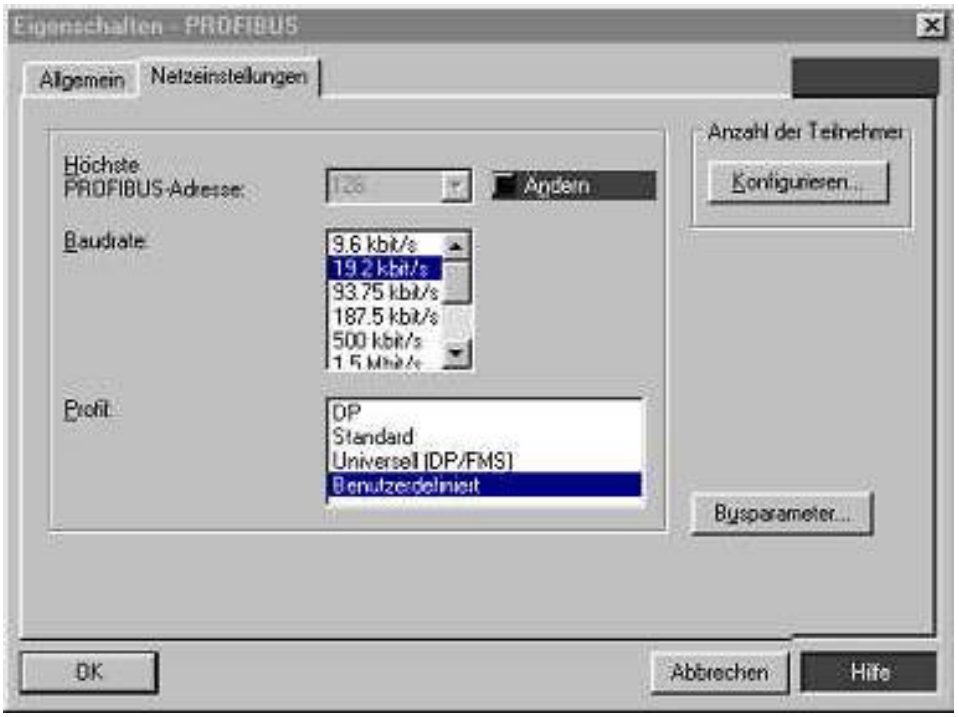

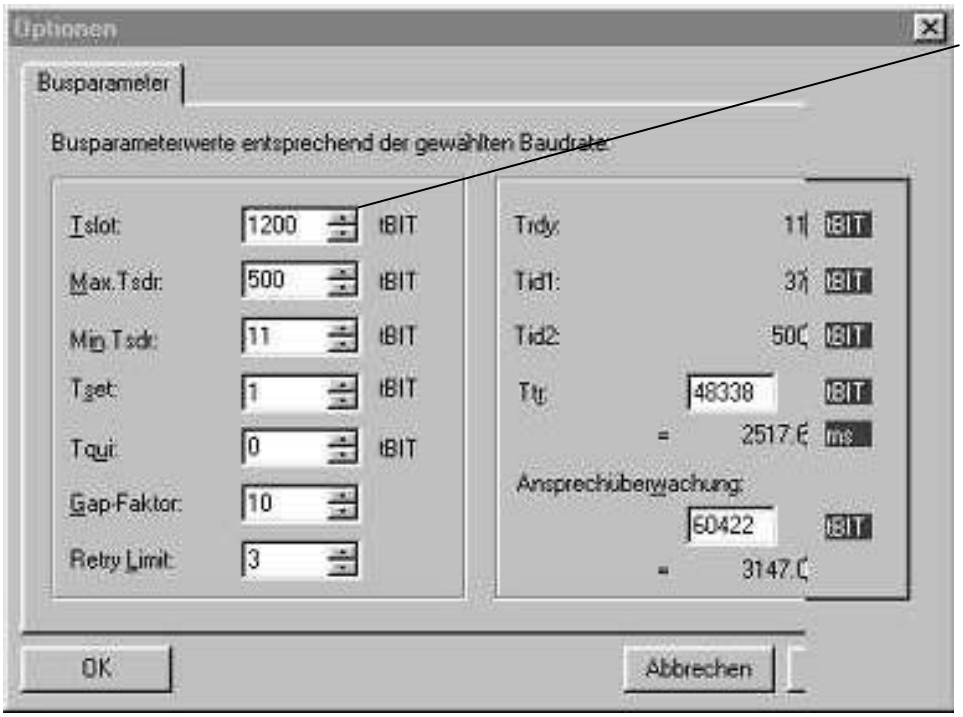

Tslot can be shortened until a bus error occurs. Initially, select a large value > 1200 tBit.

Tslot times

At 19.200 KB:	2000 - 16384
At 93.75 KB:	3000 - 16384
At 1875.5 KB:	6000 - 16384

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3.5 DE 4000 Family Functional Description

In order to accommodate the increasing employment of Ethernet in the area of automation technology, we have developed the DE 4000 Series. In contrast to more economical ”Office” products, we use Diversity antenna technology for a more stable wireless connection. In addition, our systems transmit with 100mW in contrast to Office systems, 99 % of which available on the market transmit at only 30mW. One major difference is that we transmit via wireless connections in a manner that is independent of the Ethernet PC. We therefore make an RJ45 plug-in connector available ahead of and after the transmission path. Nonetheless, the option to communicate using Ethernet PC cards is still available with the DE4000. In contrast to our other DATAEAGLE Series, the DE 4000 Series is only equipped with LED status indicators. Parameters are set using a PC and a browser.

The DE 4000 offers the following application options:
- Multiple controllers can be linked via Simatic Net assemblies;
- Programming via Step 7 and Simatic Net assembly.
- Programming via Step 7 und the MPI interface.

3.5.1 RJ 45 Connection

Using a 1:1 cable, connect the access point to, for example, a hub.
Using a 1:1 cable, connect the mobile point to a hub.

3.5.2 IP Addresses

The access point (2 antennas) has the **IP address 172.16.232.254**
The access point automatically establishes a connection with the mobile points.
Mobile point 1 has the **IP address 172.16.232.40**
Mobile point 2 has the **IP address 172.16.232.50**
The IP addresses can be changed using parameter setting software.

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3.6 DE 5000 Family Functional Description

Structurally, the DATAEAGLE DE 5000 is identical to the DE2000 MPI version, but has different software functionality. With the DE 5000, all MPI telegrams are completely transferred across the wireless transmission path, after which they are output. The bus speed here is 187.5 KB. MPI is a Siemens-specific expansion based on the Profibus. Currently, only a single MPI subscriber can be located after the wireless transmission path. However, there are no restrictions at the automation device. Depending on the CPU type, up to 4 or 16 active MPI subscribers can be connected. The DE 5000 also has a slightly different interface driver menu.

CPU side / PG side
CPU: xx PG:yy

The MPI addresses being used are specified for xx and yy. DATAEAGLE only transfers protocols with the addresses defined here.

The CPU/PG side setting refers to the control parameters from the perspective of the individual DATAEAGLE.

3.6.1 DE 5000 Family Commissioning

The MPI addresses of the two MPI communications partners must be specified in the ”Change Interface Driver?” menu. In this example, 2 for the S7 and 0 for the PG. We refer to the DATAEAGLE connected on the S7 as the ”CPU side” and the one after the wireless transmission path as the ”PG side” (under the assumption that a PG is linked via a wireless connection). Currently, various OPs (Operator Panels) have also been linked via wireless connection. In principle, only a point-to-point connection can be established.

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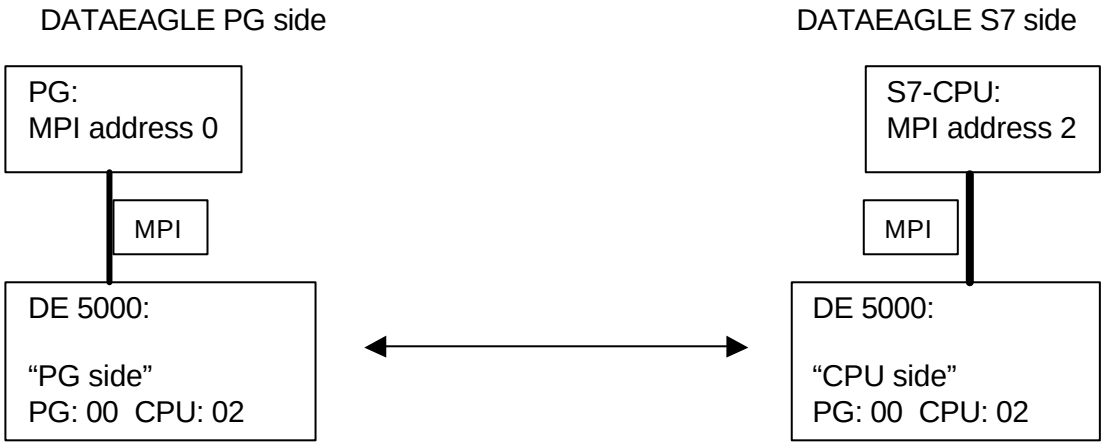
- Use "🡐" or "➔" to enter the password menu.
- Using the arrow keys, set the password (default value = "00") and confirm with "ENTER".
- Use "➔" to switch to the "Change Interface Driver" menu and confirm with "ENTER
- Along with the PG addresses, the wireless addresses must also be set, just as with all other DATAEAGLE versions (refer to setting wireless addresses).
- Confirm the settings with "ENTER", then use escape to return to the idle menu.
- The DE5000 is now ready for "transparent" MPI communications.

The following example shows the MPI address setting



3.6.2 Transparent Cellular Telephone for the MPI Interface with the DE 5500

The DE 5500 version also permits a transparent cellular telephone MPI connection.
The MPI bus operates at 187.5 KB. The data themselves are transmitted via GSM at 9600 baud. The subscribers connected to the MPI bus notice nothing different. The user only notices a somewhat longer transfer time. The overall system is slower by a factor of 20 when compared to a hardwired direct connection. The MPI interface and the GSM path are uncoupled from one another so that there is no feedback effect between the two.

This system is of particular interest for worldwide remote maintenance. Both subscribers require appropriate SIM cards with data reception release capability. The DE 5500 menu has been expanded to include the items, "Enter Telephone Number" and "SIM Code".

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4 General Commissioning Notes

DATAEAGLE is ready to use (with the exception of the DE 4000). Two antennas are required for each DATAEAGLE. After being unpacked, they must be mounted on the antenna sockets on the wireless modules. Optimal wireless connections are obtained in line-of-sight situations with the antennas aligned equally and with generous distances to interference sources, walls, and metal structures. The best results are achieved if the DATAEAGLEs are mounted at an elevated and open location.

For initial commissioning, we recommend setting up the units without a connected controller and at a distance of approx. 2 m to one another, and supplying them either directly with 24 VDC or using a mains power pack.

Even without connected controllers, the two DATAEAGLEs can find each other through a test mode in order to check the quality of the wireless connection. An LCD display in the DATAEAGLE displays the test results. This allows the optimal locations and settings to be determined.
(Refer to Measuring the Transmission Quality)

4.1 Switching on the Supply Voltage

The nominal supply voltage is 24 VDC. However, the DATAEAGLEs are designed for an operating voltage range of 9V – 33V DC. The input terminals are reverse-proof and equipped with input protection filters. The input circuit contains a 0.7A self-resetting fuse. This fuse cannot be replaced. If the fuse blows, the unit must be disconnected from the power supply for approx. 2 minutes. Before switching the supply voltage on again, make sure that the supplied power lies in the 9 to 33 V DC range. The output for the 230V AC mains components is also connected to this socket.

After the supply voltage is switched on, DATAEAGLE displays the following message:

4.2 Device Version Identification

DE aaaa V x.y

aaaa: Type designation
:x.y: Indicates the software revision level.

The hardware revision level (version) is shown on the nameplate on the back of the unit. This code provides the PCB version. All mechanical and circuit modifications are identified by an expanded numeric code. For reasons of compatibility, we recommend always using units with the same hardware and software revision levels. If this is not possible, for example because of expansions to the facility, please contact us for information concerning device compatibility.

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4.3 Display at Idle

Approx. 1 second after switching the unit on, the following standard message appears:

```
<- Idle ->
P:aa S:bb F:cc
```

aa is the partner address specified under “Wireless Addresses”.
bb is the station address specified under “Wireless Addresses”.
cc is the wireless channel.

In the delivered state, the following messages appear on the display:

DATAEAGLE 1

```
<- Idle ->
P:01 S:02 F:01
```

DATAEAGLE 2

```
<- Idle ->
P:02 S:01 F:01
```

The unit is in its base state and a quality measurement can be made.
Refer to Measuring the Transmission Quality

When data transfer is active, the “Communication” message appears.

```
<Communication>
P:01 S:02 F:01
```

In wireless networks with multiple slaves, the “Idle” message may occasionally be displayed by the slaves. The ”Communication” display is merely a monoflop function triggered by received data. A changeover from communication to idle therefore is not significant.

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4.4 Device Settings Using the Keyboard and Display

All DATAEAGLE settings are saved in an EEPROM, even in case of a power failure. Settings are made using the four arrow keys, cancel (ESC), and confirm (Enter), as well as the display.

The settings menu is protected against accidental access by a 2-digit password. At delivery, this password has been set to a default of “00”. The arrow keys are used to input it. The password can be changed by using the “Password” menu.

Use the **right arrow** and **left arrow** keys to move within a menu level in order to, for example, select a different function.
Use the **up arrow** and **down arrow** keys to change parameters and numeric values. Correct entries are confirmed with “ENTER”, causing the specified parameter to be saved. Use “ESC” to exit the input without saving it and return to the next higher menu level.

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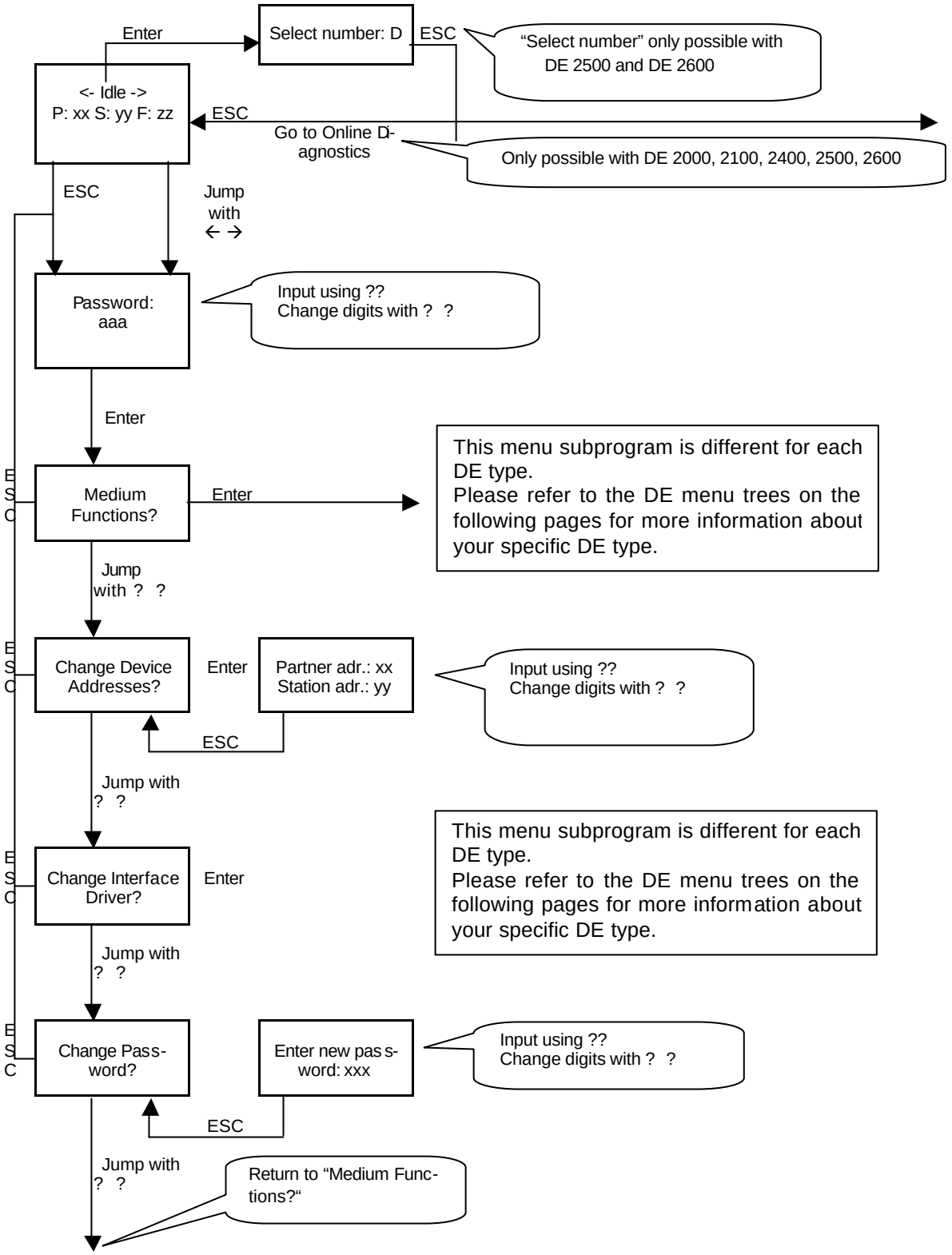
4.5 Main Menu Structure of the DE Family



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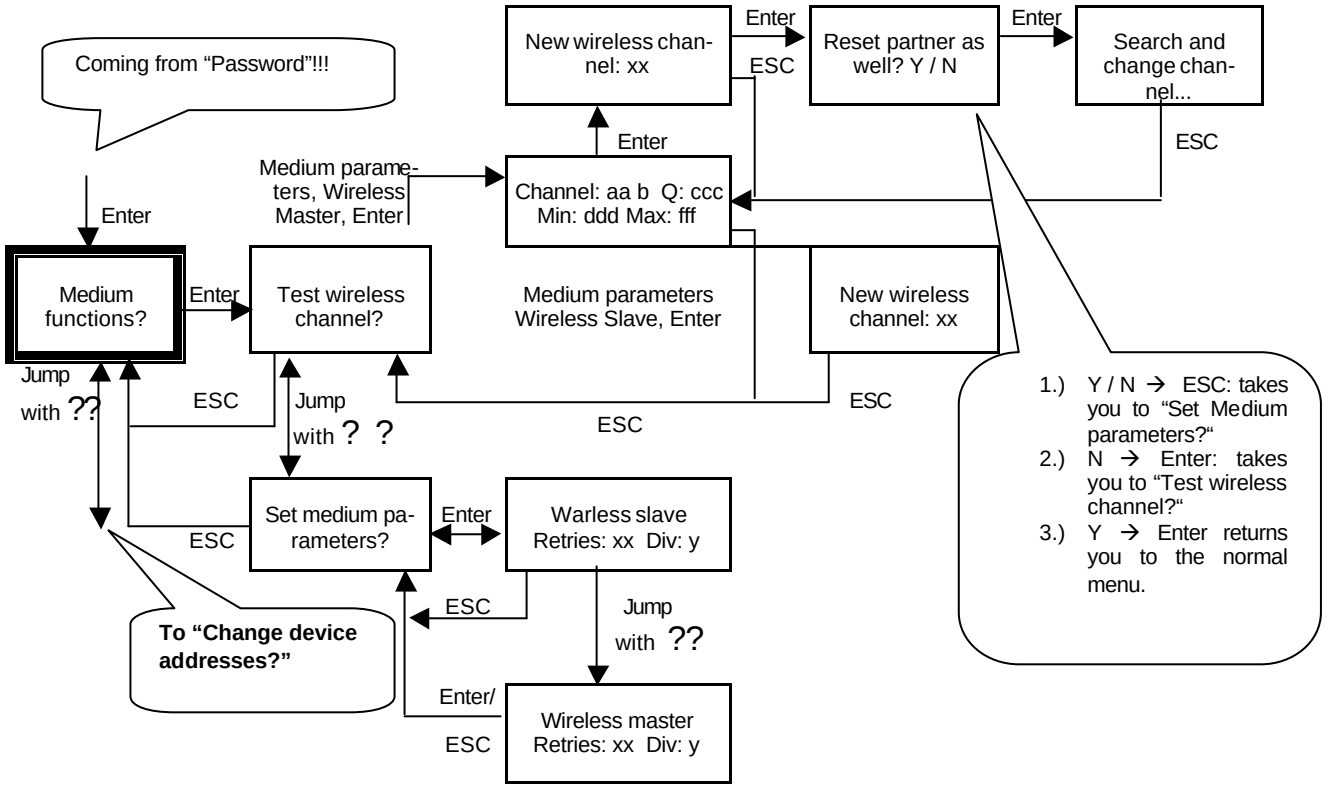
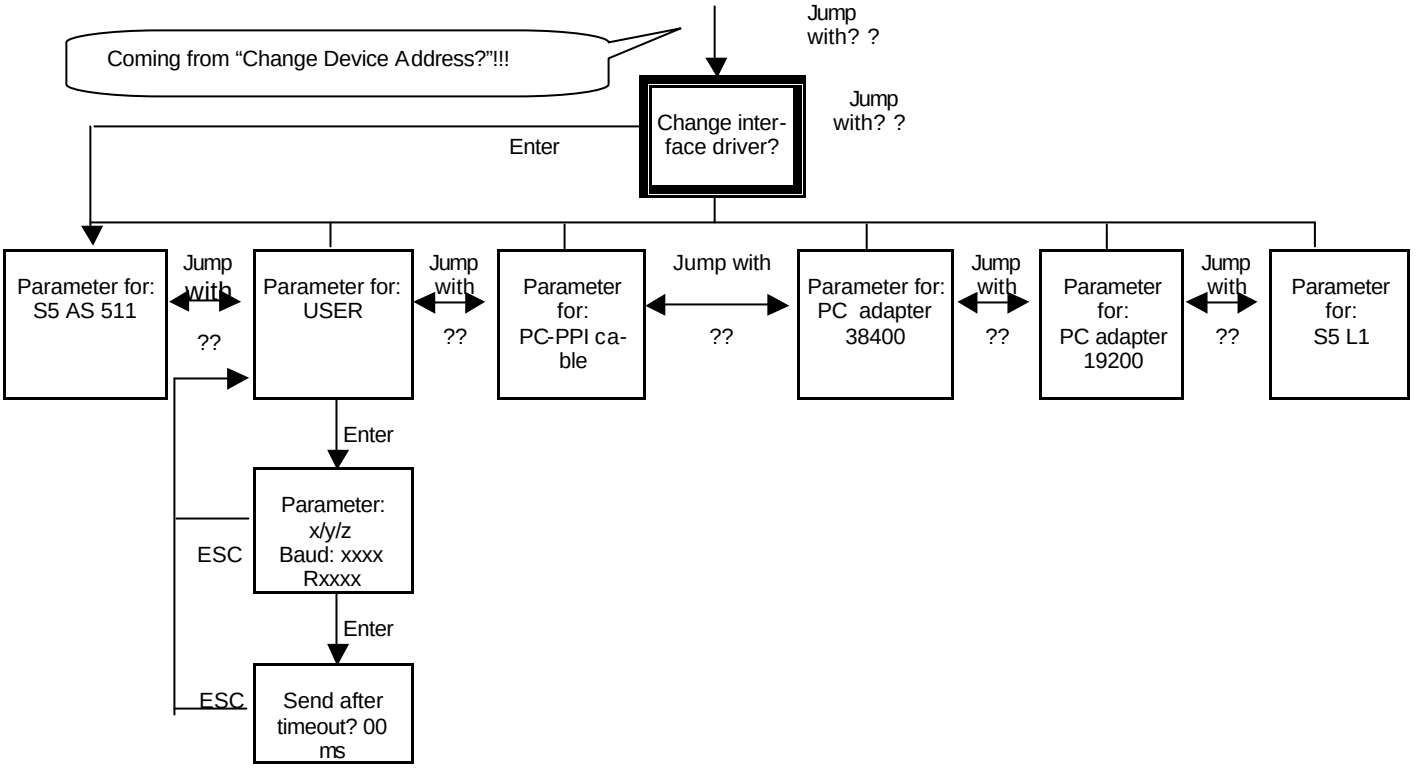
4.6 DE 1000 Medium Functions Menu Subprogram



DE 1000 Interface Driver Menu Subprogram



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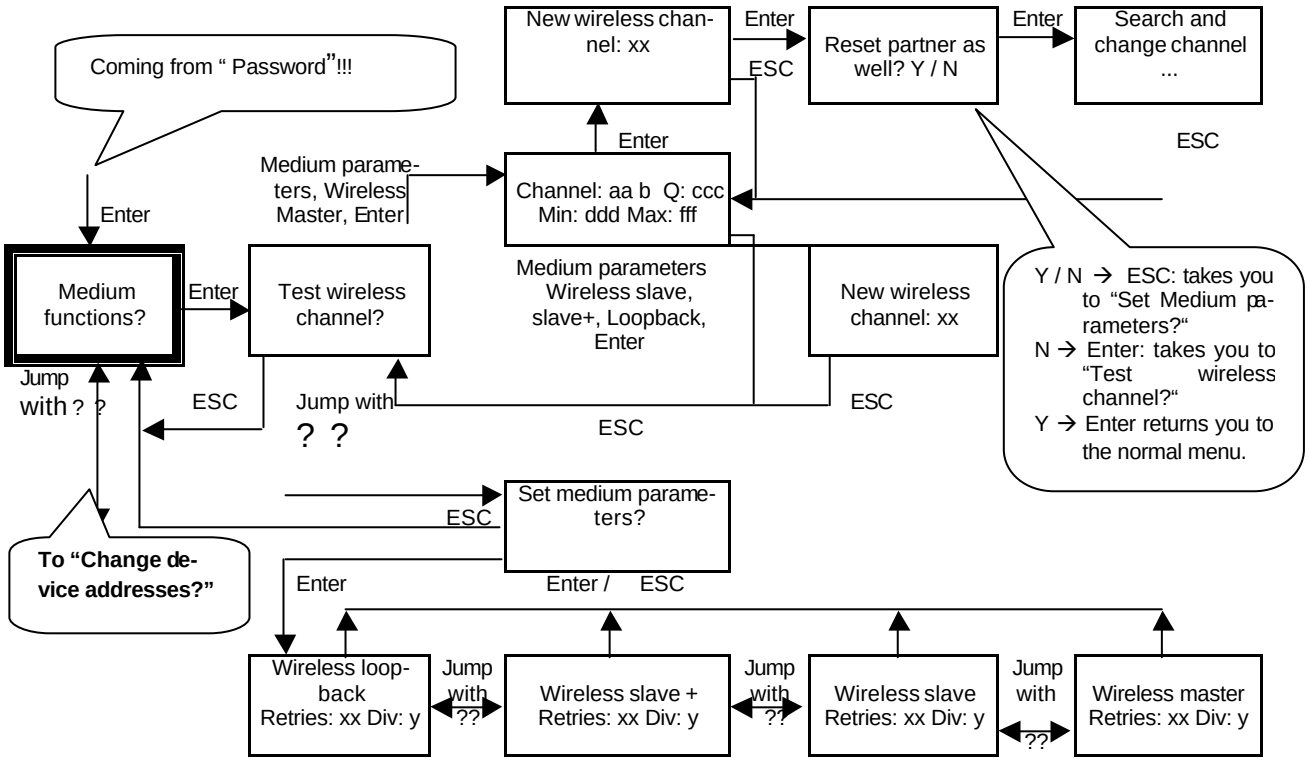
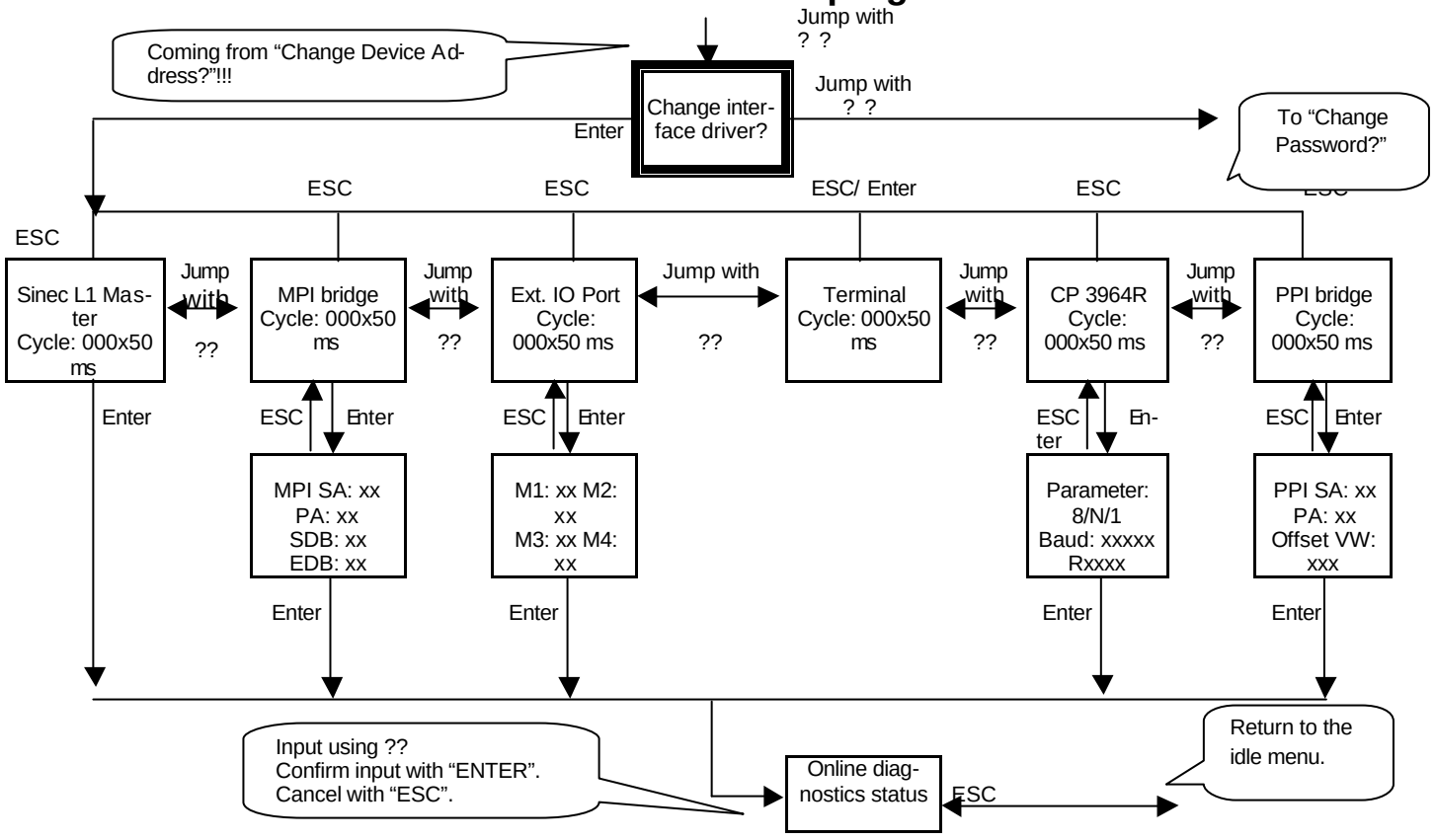
4.7 DE 2000 Medium Functions Menu Subprogram



DE 2000 Interface Driver Menu Subprogram



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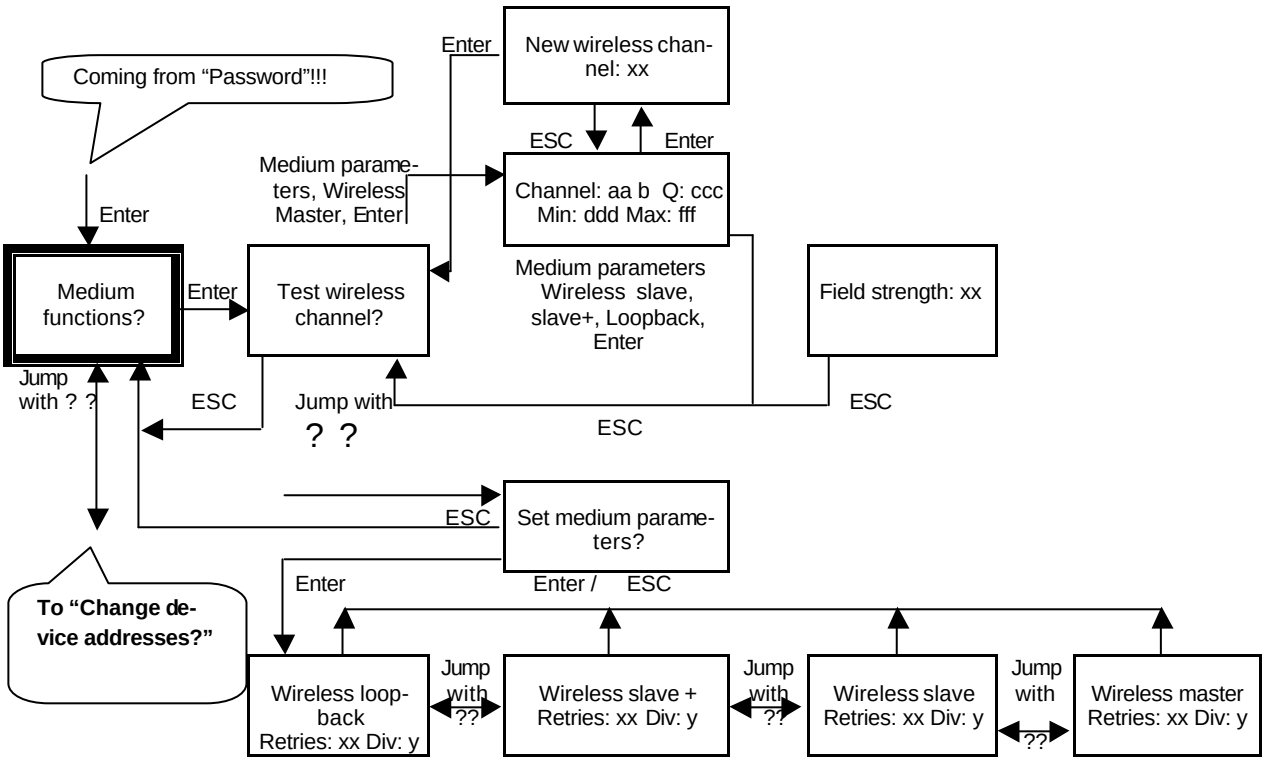
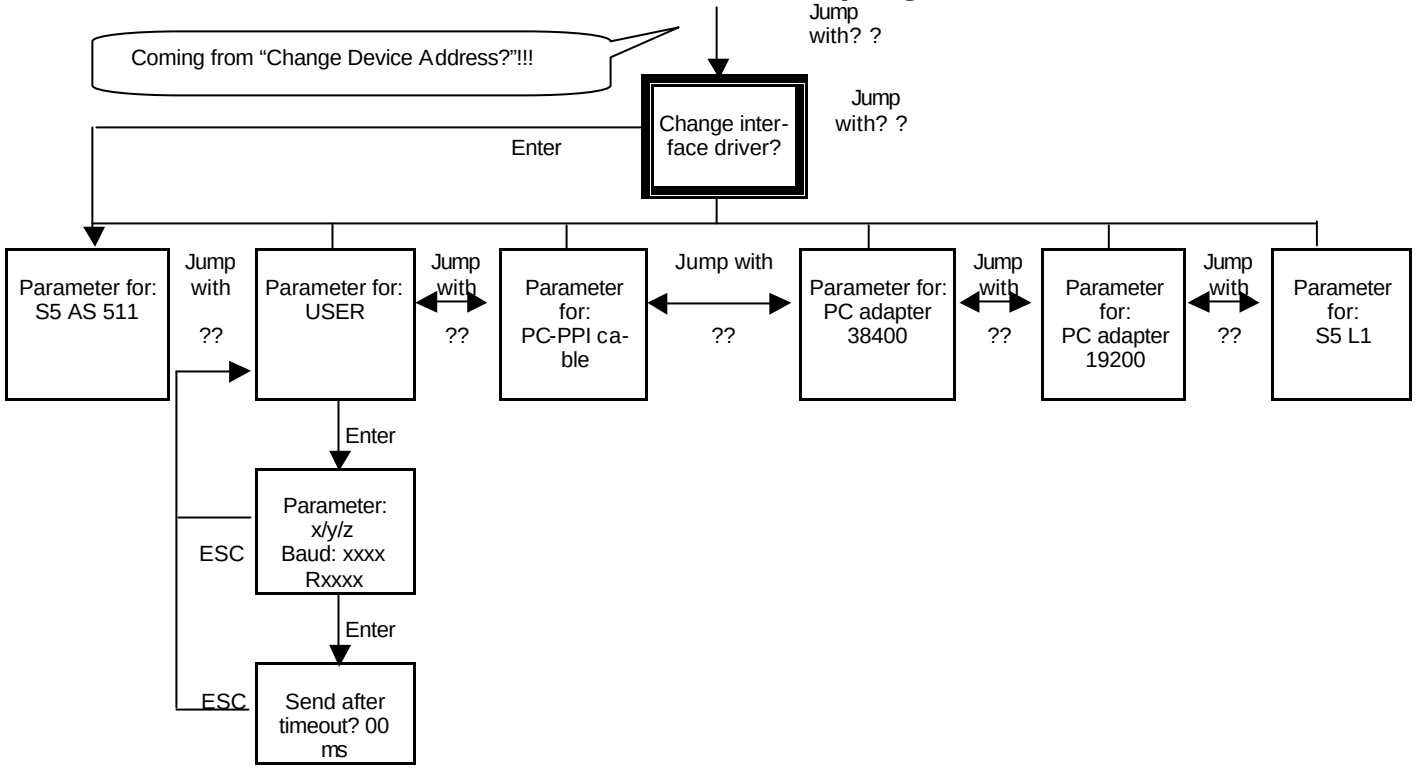
4.8 DE 2100 Medium Functions Menu Subprogram



DE 2100 Interface Driver Menu Subprogram



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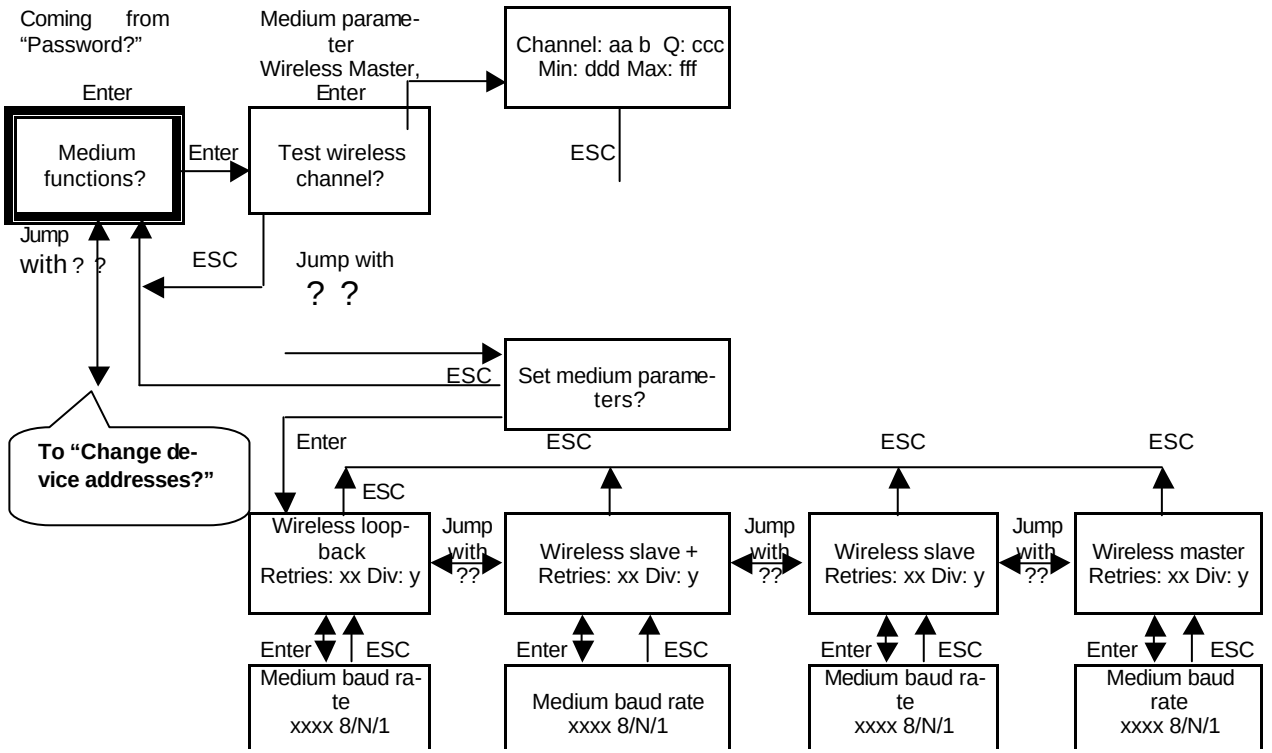
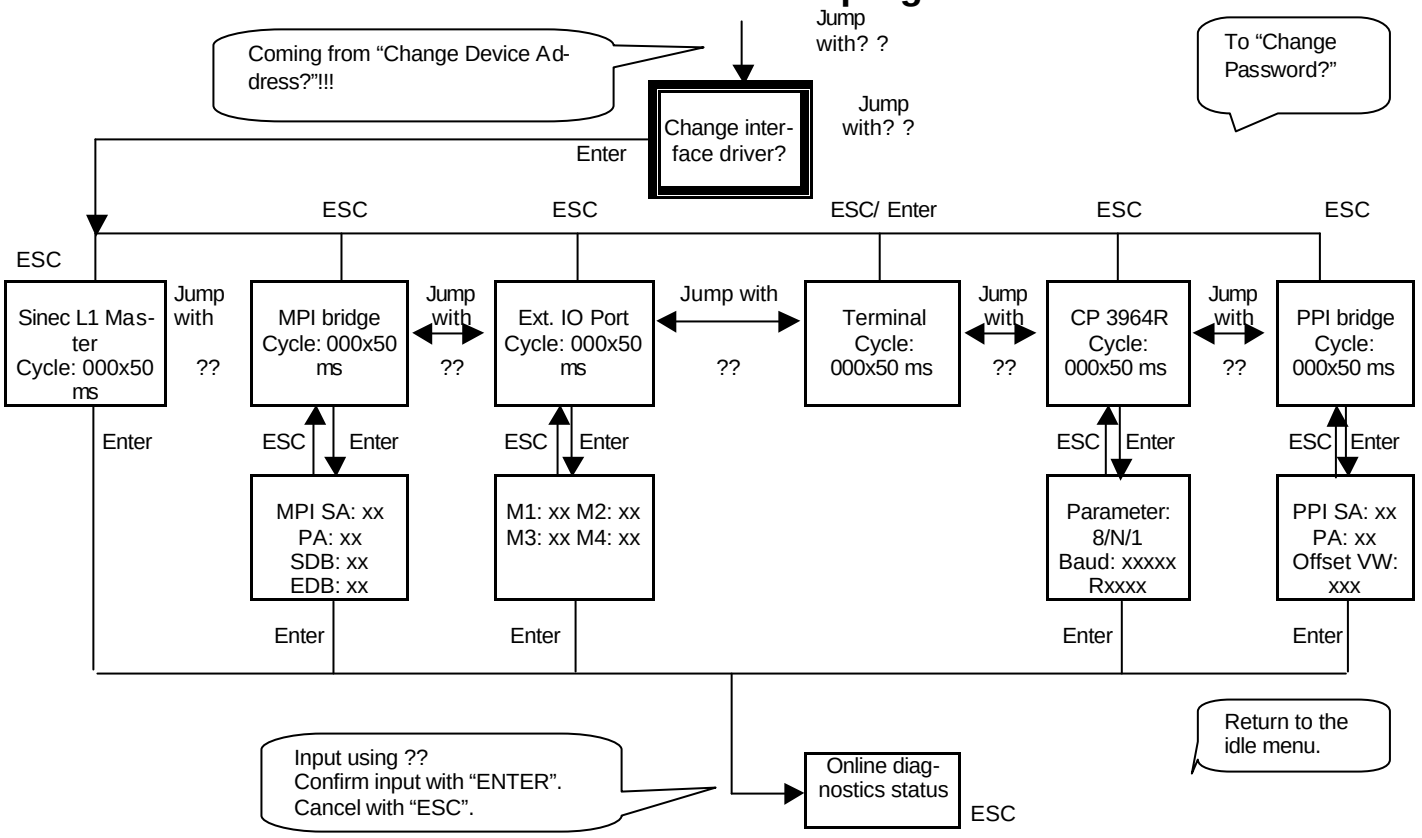
4.9 DE 2400 Medium Functions Menu Subprogram



DE 2400 Interface Driver Menu Subprogram



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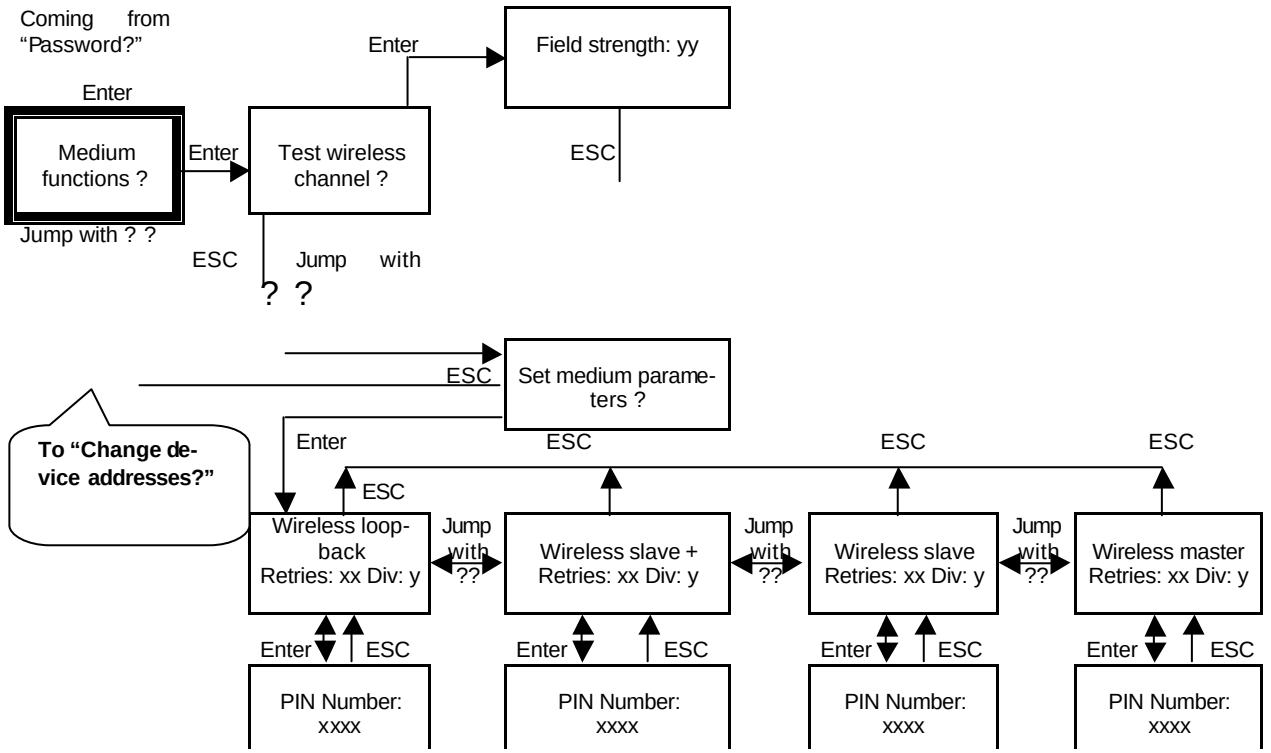
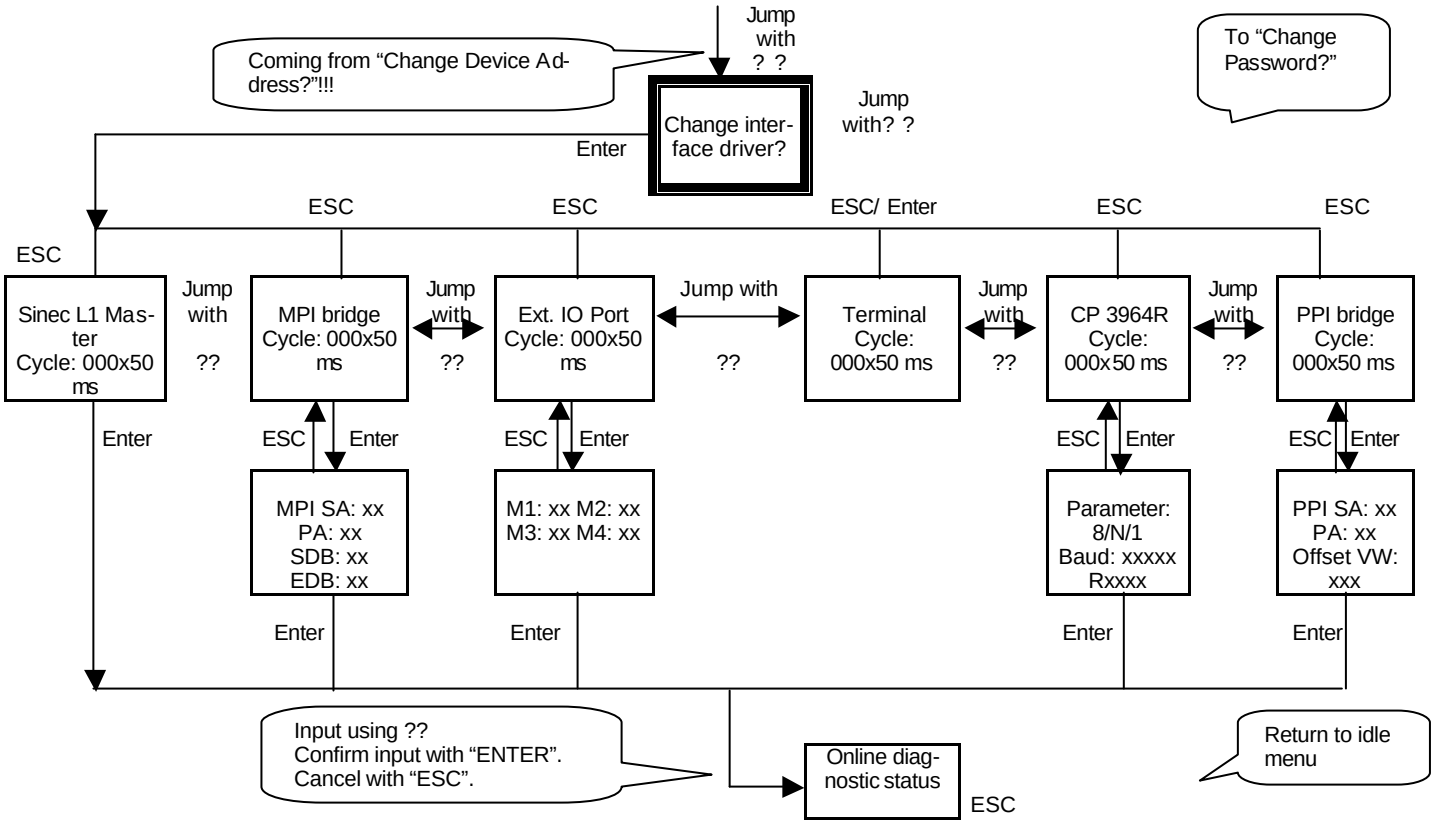
4.10 DE 2500 Medium Functions Menu Subprogram



DE 2500 Interface Driver Menu Subprogram



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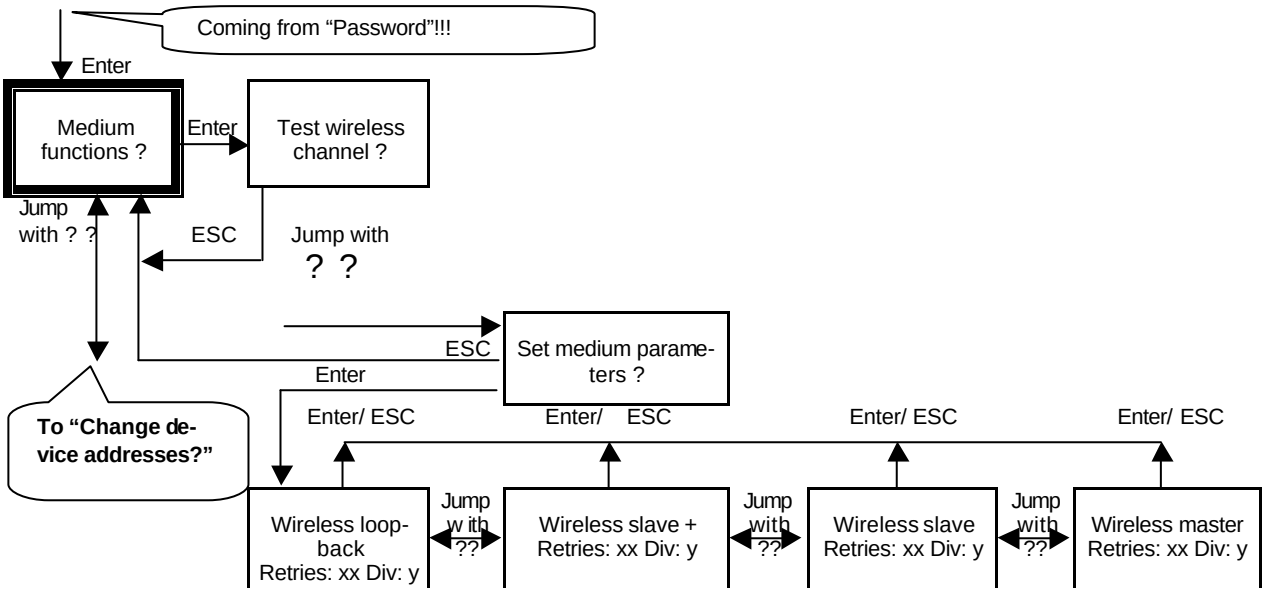
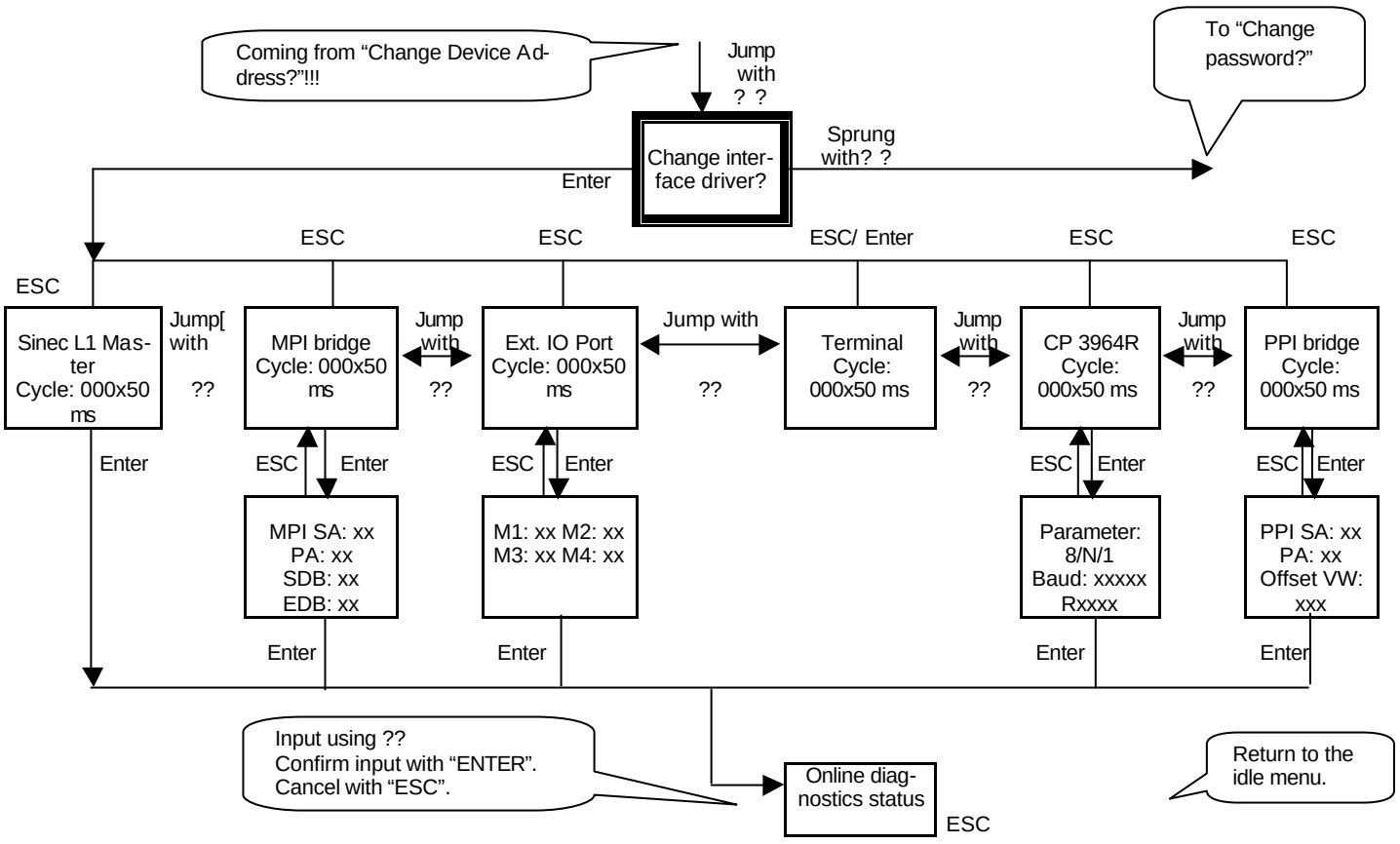
4.11 DE 2600 Medium Functions Menu Subprogram



DE 2600 Interface Driver Menu Subprogram



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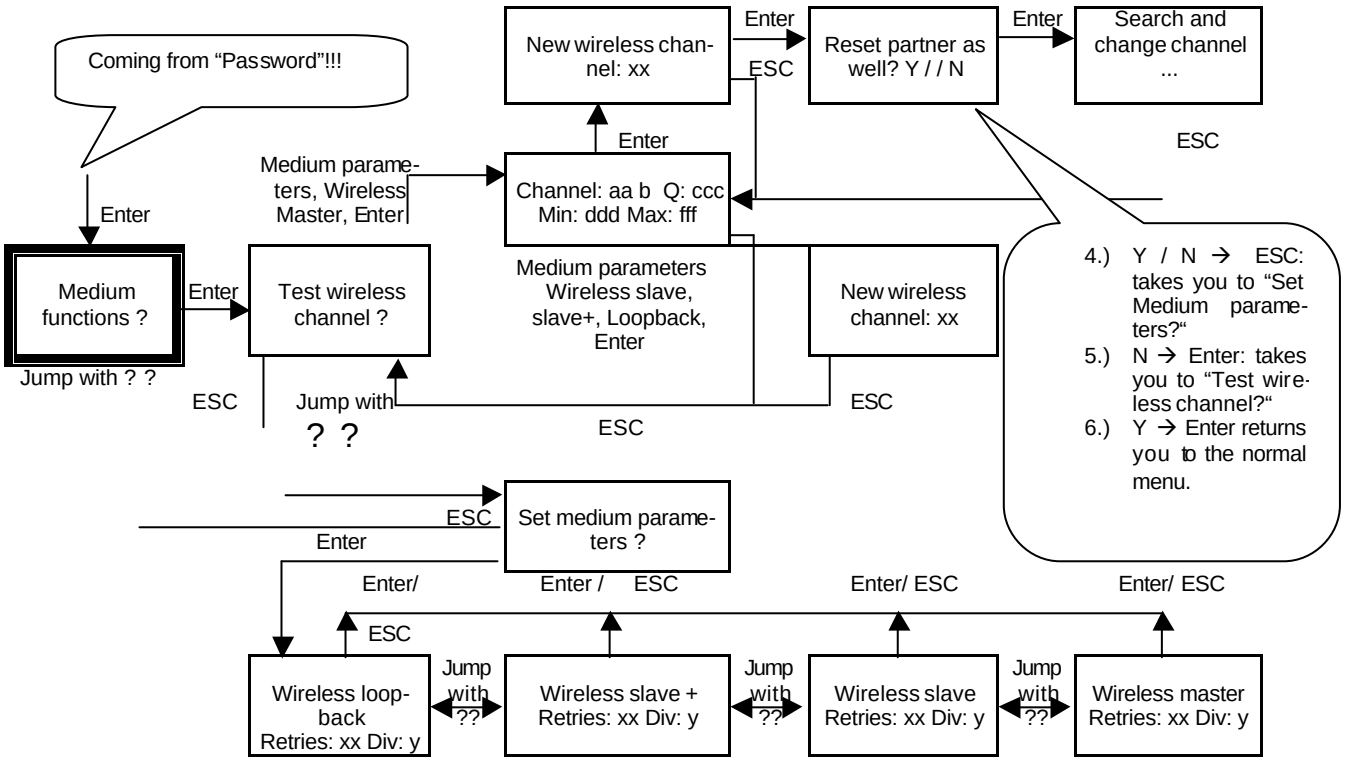
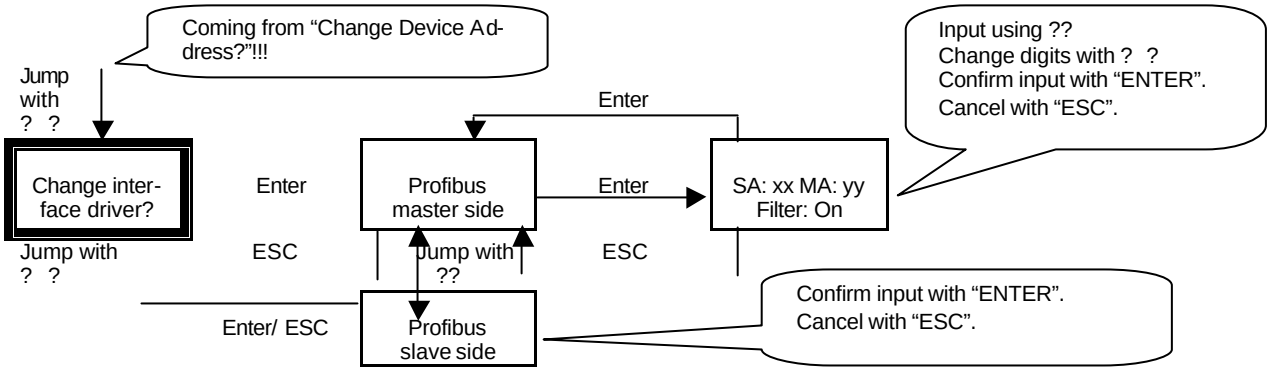
4.12 DE 3000 Medium Functions Menu Subprogram



DE 3000 Interface Driver Menu Subprogram



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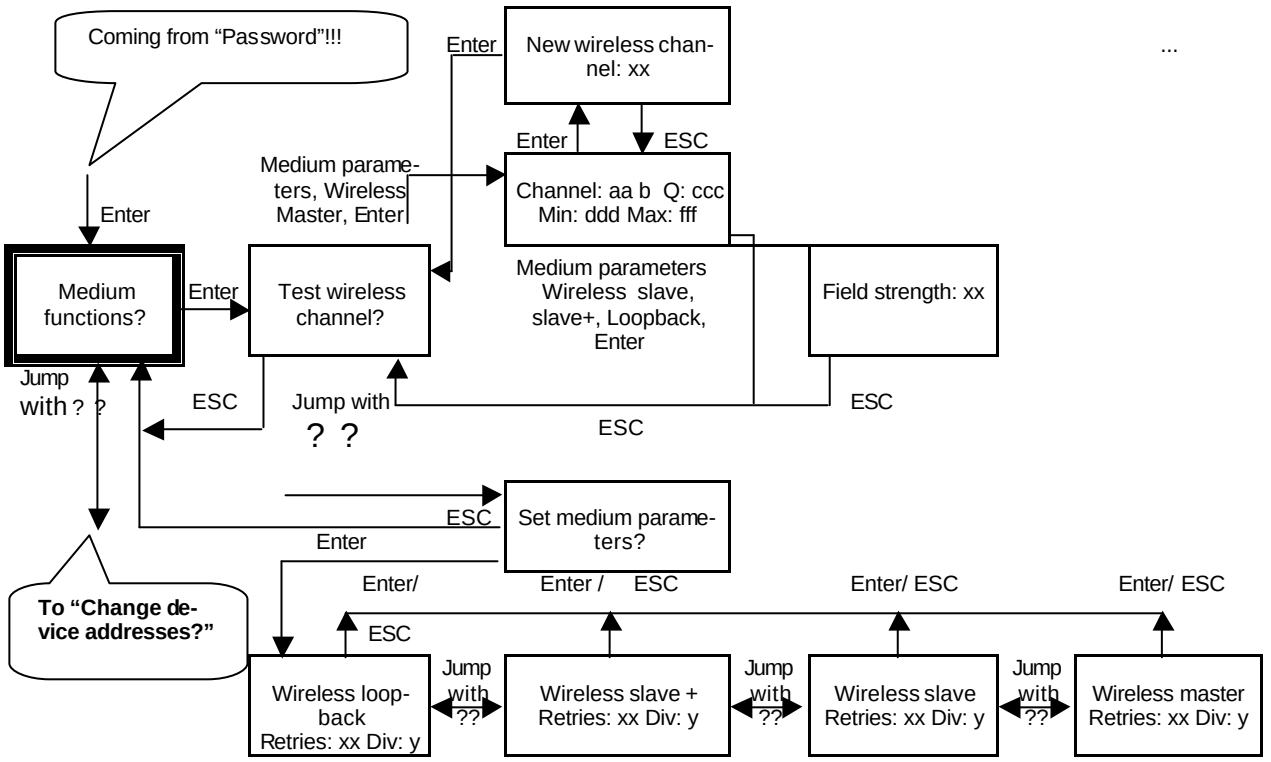
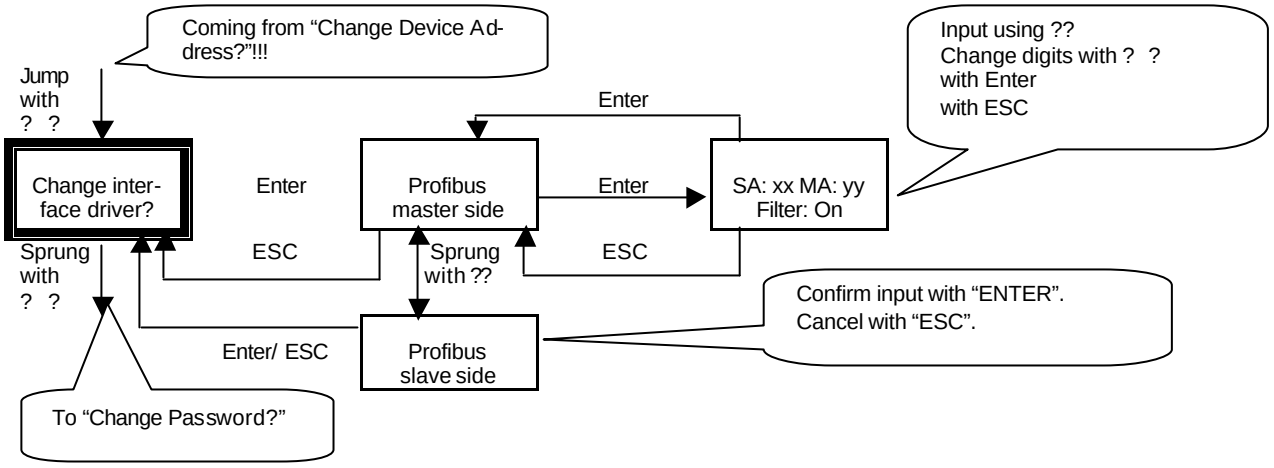
4.13 DE 3100 Medium Functions Menu Subprogram



DE 3100 Interface Driver Menu Subprogram



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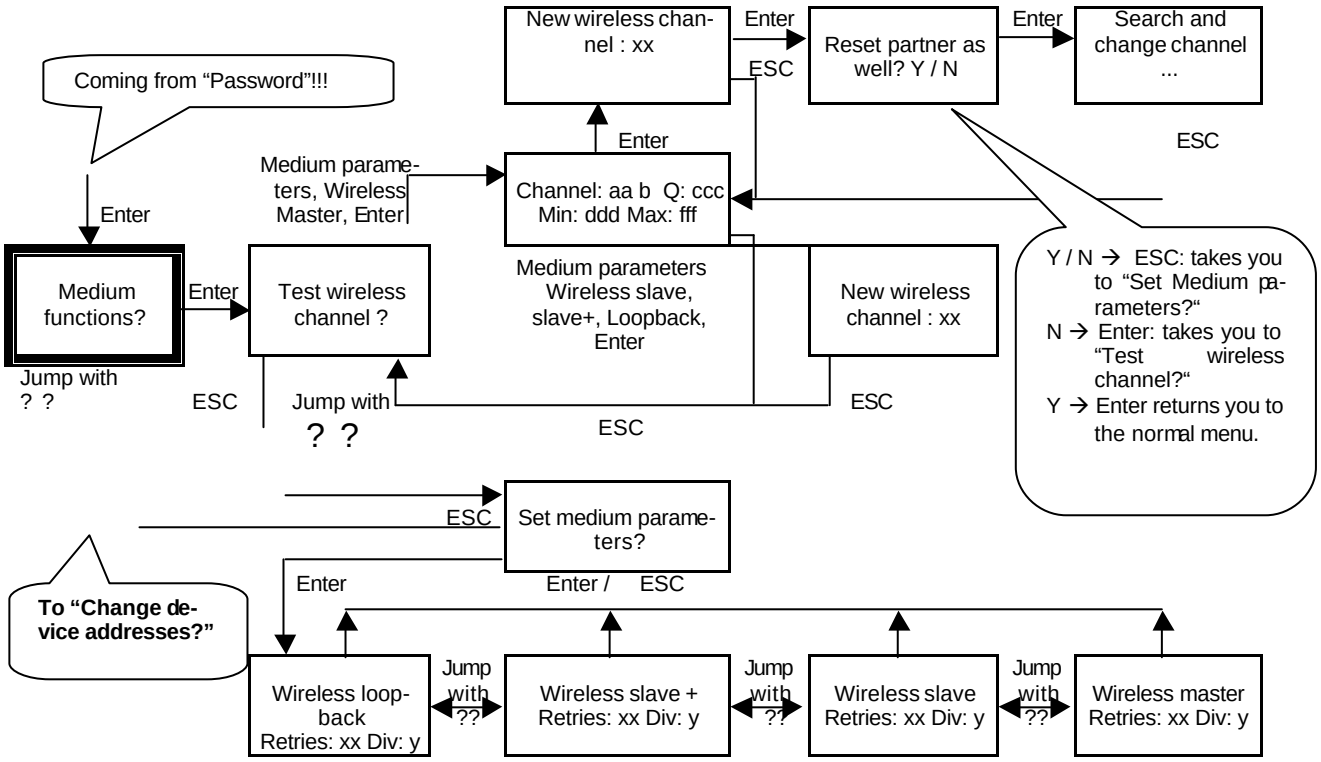
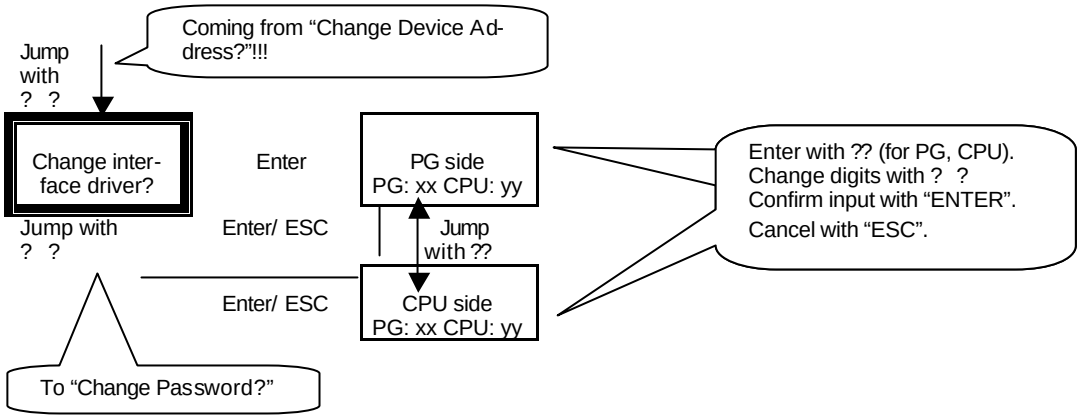
4.14 DE 5000 Medium Functions Menu Subprogram



DE 5000 Interface Driver Menu Subprogram



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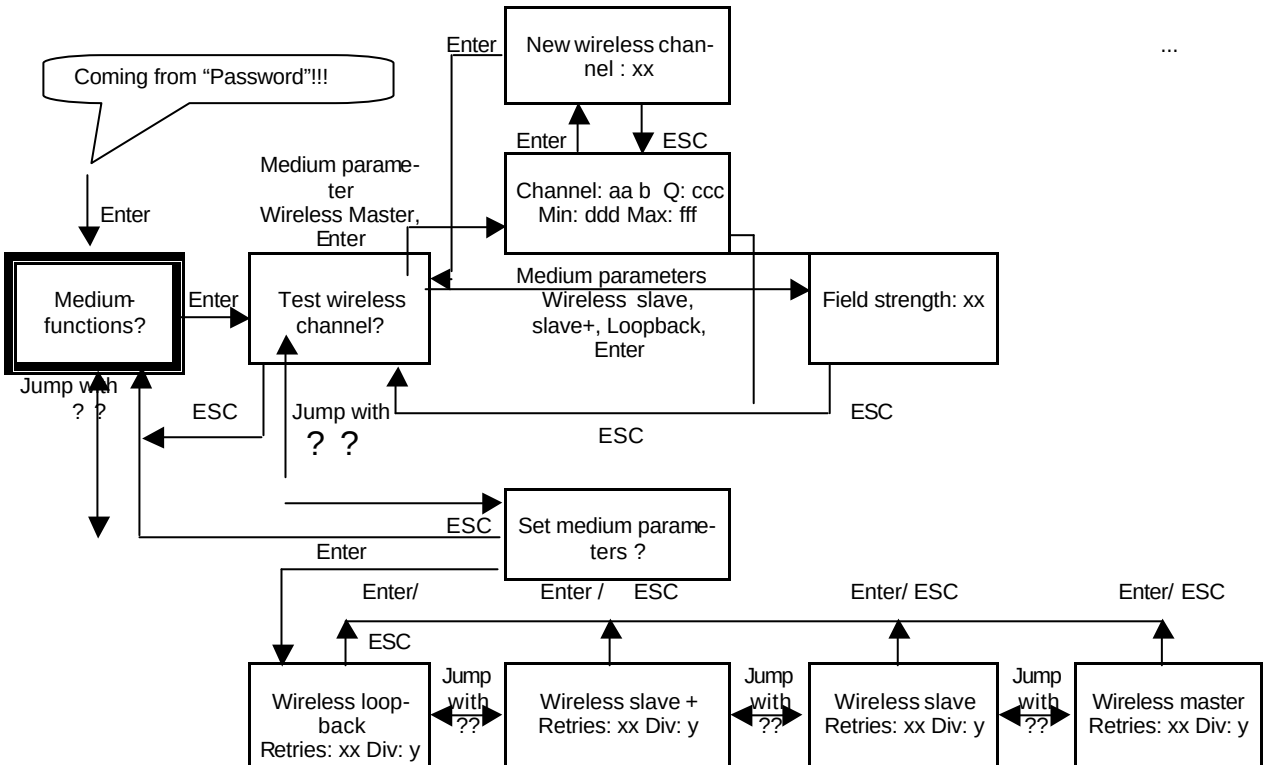
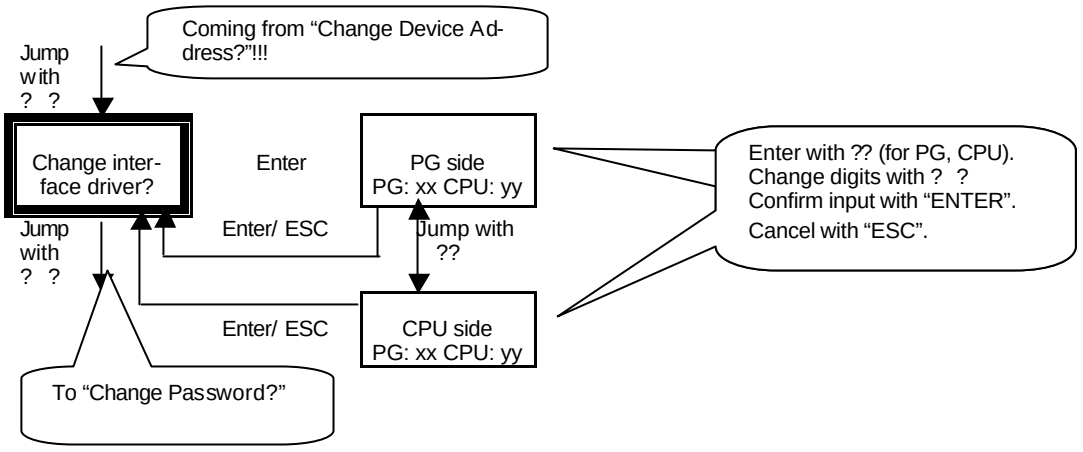
4.15 DE 5100 Medium Functions Menu Subprogram



DE 5100 Interface Drive Menu Subprogram



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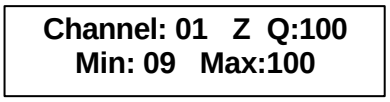
4.16 Measuring the Transmission Quality



You can perform a quality test by going to the "**Wireless Channel Functions"** menu item. This test can only be started from the wireless master. This function offers a very simple way of testing whether the channel is being used by other subscribers and whether the partner station is accessible. For this test, a DATAEAGLE transmits data packets which are received by the partner and mirrored back. The sender then tests the data throughput. A value between 0 and 100 is then displayed. A value of 100 indicates a transmission with the maximum possible data throughput. Because the wireless protocol is error tolerant, values below 100 are also suitable for data transmission. A quality level of, for example, 90 means that the maximum data throughput is 90%. In practice this means that the transmission time on the wireless side increases by approx. 10%.

In practice you will achieve values between 50 and 100%.

Where the quality values are poor, the wireless telegram must start several transmission attempts before the transfer is successful. If the values are below 50, we recommend using a different wireless channel. If "---" is displayed instead of a number, transmission is not possible. Possible causes for this error include:

- The distance to the partner station is too great;
- The partner is no longer set to the correct channel, station, or partner address;
- The antennas have been incorrectly installed or are not installed at all;
- Interference on the wireless side.

The minimum and maximum quality values achieved are also shown, together with the currently measured transmission quality. This allows long-term measurements to be made. One practical application of this would be, for example, taking measurements on a given wireless channel overnight in order to determine whether transmissions were able to be made at all times. Using Windows DEMon diagnostic software, a quality test can also be performed from a PC, however, this test must be made during ongoing operation.

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4.17 Setting the Wireless Channel

The ISM 2.4GHz band permits subdivision into 58 channels. Subscribers can only communicate with one another on the same channel. Because these channels can also be used by other subscribers, the transmission quality of the channel must be tested and, if necessary, the channel must be changed. No channel settings are possible with DECT, 448/459/869 MHz GSM.

Pressing “ENTER” in the **“Wireless Channel Functions”** menu item takes you to the submenu where you can change the channel.

The top line shows the currently selected channel. Pressing **Enter** brings up the channel input mask. The channel can then be reset with the aid of the **Up** and **Down** arrow keys. The left and right arrow keys are used to change the individual digits.

New channel: 02
HF retries: 10

4.18 HF Retries (2.4GHz Wireless System)

The “HF retries” input field is used to specify how many times the DATAEAGLE on the wireless side will attempt to carry out a faulty wireless transmission before terminating that particular operation and transmitting new data. The default setting is 10.

The HF retries entry has a strong effect on the transmission speed, particularly in the case of the DE 3001. Here, values below 3 are the most practical. In this case, the Profibus assumes control of the retries. Values that are too high can result in the Profibus master frequently reporting Bus errors.

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4.19 Setting the Partner and Station Address

Each DATAEAGLE requires a station address. The station address of the partner device is the so-called “partner address” and must also be entered in both wireless modems. The setting is made or can be changed in the **Device Addresses** menu. The correct station and partner address settings are very important for proper operation. The address of the sender (station address) and that of the receiver (partner address) are transmitted in the wireless telegram. The receiver will only accept data with a matching address. You can enter values from 0 – 99.

A partner address of 0 indicates broadcast messaging. With the DE1000 and DE3001 this allows transmission to multiple DATAEAGLE receivers.

Example:

DATAEAGLE 1	DATAEAGLE 2
Station address 10	Station address 20
Partner address 20	Partner address 10

Wireless network operation with the DE 2000 represents a special case. Here, several partners can be defined in the controller’s transmit and receive drawer. In this case, the partner address is only used to for the quality test and, during ongoing operation, is taken over by the controller. The current partner is addressed in the “Partner address” variable field of the data building block.

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4.20 Reset Default Parameters (Factory Settings)

To return the DATAEAGLE DE1000/2000/3000/5000 to their respective default settings, first switch the unit off and hold down the “ESC”, then switch the device on again.

DE 1000 default values:

Baud rate	9600
Format	Even Parity
Wireless channel	1
HF retries	10
Parameter for	AS511 S5
Partner address	1
Password	00
Interface driver	Transparent
Station address	1

DE 3000 default values:

Wireless channel	1
HF retries	10
Partner address	1
Password	00
Interface driver	Profibus master side
Station address	1

Communications between two DATAEAGLES is not possible with these default settings! Different station and partner addresses must first be defined on both sides.

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4.21 Wireless Modem Installation Options

Cap rail mounting for circuit cabinet installation	Standard
Large area Klett connection	Optional
Vertical bracket	Optional
Horizontal bracket	Optional
Installation in wall-mounted housing	Optional

For outdoor applications, we can provide fully assembled units with mounted antennas.

If no circuit cabinet is available, we recommend the use of a plastic housing for wall-mounted installation.

Housing part no.: 10578
Dimensions: 380 x 190 x 130
IP 67
Polycarbonate
Temperature range: –40°C to + 80°C
Color: RAL grey 7035
Flammability: UL 94-V2

Mounted antennas: 2 x 10277 omnidirectional
PG terminal for communications connection (MPI , Profibus)
PG terminal for power supply connection
Galvanized back with cap rail

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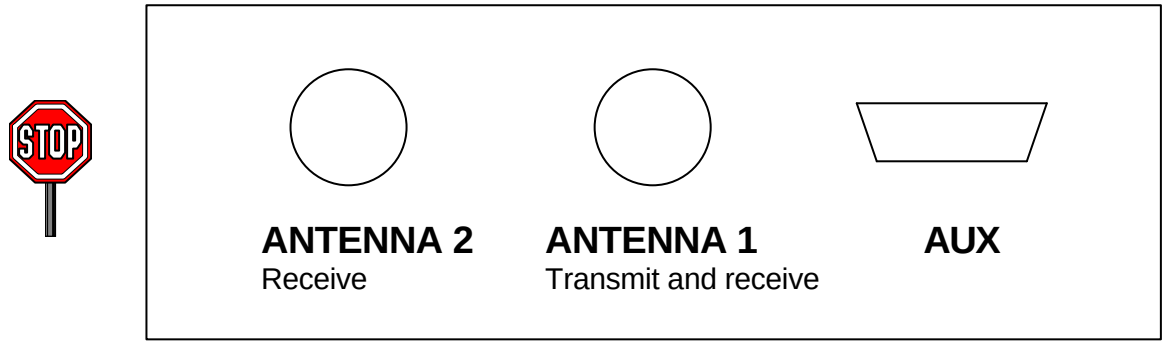
5 Antennas

5.1 Antennas for 2.4GHz

5.1.1 DATAEAGLE SMA Antenna Connection

The DATAEAGLE for 2.4GHz wireless systems (DEx000) is equipped with two separate HF inputs and, consequently, with two SMA antenna connections. Antenna 1 transmits and receives, while antenna 2 only receives. The DE automatically switches to the better reception channel. Where the antennas are external, we therefore recommend mounting them as far apart as possible. Antenna mounting is crucial for the quality of the data transmission to moving objects (e.g., cranes). We refer to the operation with two antennas as the DIVERSITY mode.

View of a DATAEAGLE from the antenna connection side with SMA connectors



Both antennas must always be connected, otherwise the HF output stage may be destroyed. If external antennas are connected, both antennas should be mounted between 20 cm and 100 cm apart.

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5.1.2 Antennas with Gain

Legislation has restricted the transmitting power at 2.4GHz to 20dbi = 100mW. Therefore, the employment of antennas with antenna gain is only permitted to a limited extent for transmitting. This value is the sum of the DATAEAGLE transmitting power and the antenna gain. DATAEAGLE transmits at 18db + 2 db antenna gain. Wire and connection dampening of an additional approx. 2 db permits antennas with a total gain of 4db to still be used for transmitting without endangering the general license. Gain antennas with more than 4db may only be connected to antenna 2 on the receive side. The Diversity Mode allows us to significantly increase the range by employing antennas with high antenna gain on the receive side without this resulting in a loss of the general operating license.

5.1.3 Available Antenna Types, 2.4GHz

The following antennas are available:

Antenna type	PN	Description	Application
DE_AN_A	10248	90° angle antenna	Indoors Transmit and receive
DE_AN_L2	10277	Omnidirectional antenna, hole mounting 2.5 dB antenna gain	Outdoors, circuit cabinet, mobile component Transmit and receive
DE_AN_L4	10361	Omnidirectional antenna 4 dB antenna gain	Outdoors, circuit cabinet, mobile component Transmit and receive
DE_AN_L7	10362	Omnidirectional antenna 7 dB antenna gain	Outdoors, circuit cabinet, mobile component Receive only
DE_AN_L9	10354	Omnidirectional antenna 9 dB antenna gain	Outdoors, circuit cabinet, mobile component Receive only
DE_AN_R8	10249	Directional antenna 8dB antenna gain	Outdoors, fixed station Receive only
DE_AN_R14	10272	Directional antenna 14dB antenna gain	Outdoors, fixed station Receive only
DE_AN_R18	10270	Directional antenna 18dB antenna gain	Outdoors, fixed station Receive only
DE_AN_R6/18	10360	Directional antenna 6 dB antenna gain, transmit 29dB antenna gain, receive	Outdoors, fixed station Transmit and receive, input 1!

A separate power supply and a DC feed link are required for the 10360 antenna.

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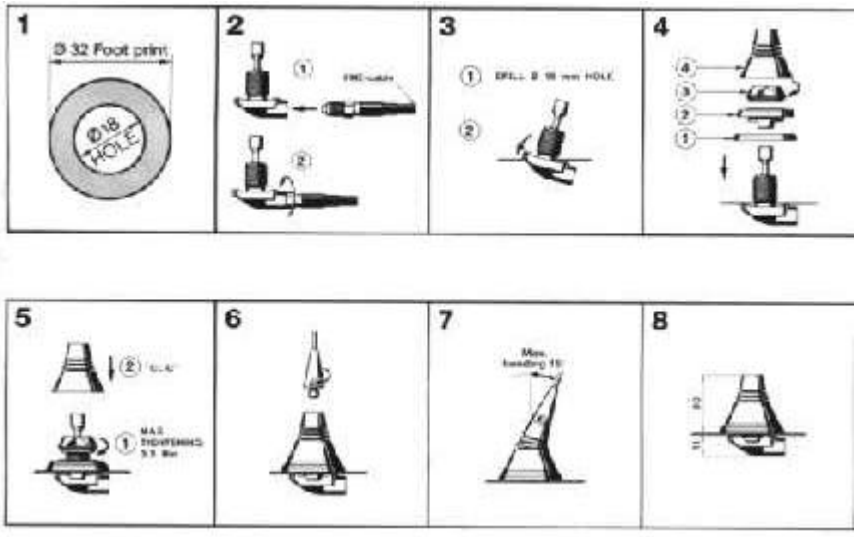
5.1.3.1 10277 Omnidirectional Antenna, Circuit Cabinet Installation

Height: 140mm
Antenna gain: 2.5 db
IP 65 protection class, suitable for outdoor installation



Assembly instructions for the 10277 omnidirectional antenna

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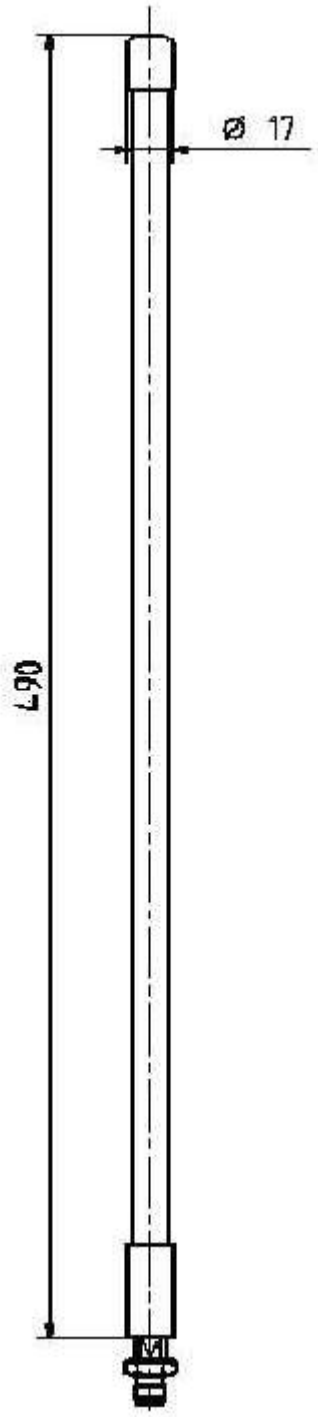
5.1.3.2 Omnidirectional Antenna, Part No. 10362, 7db



Antenna gain: 7db
Length: 490mm

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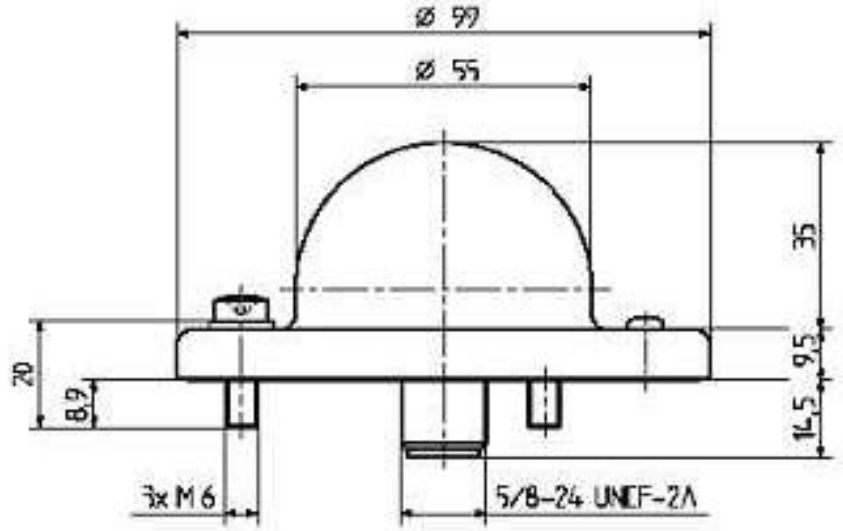
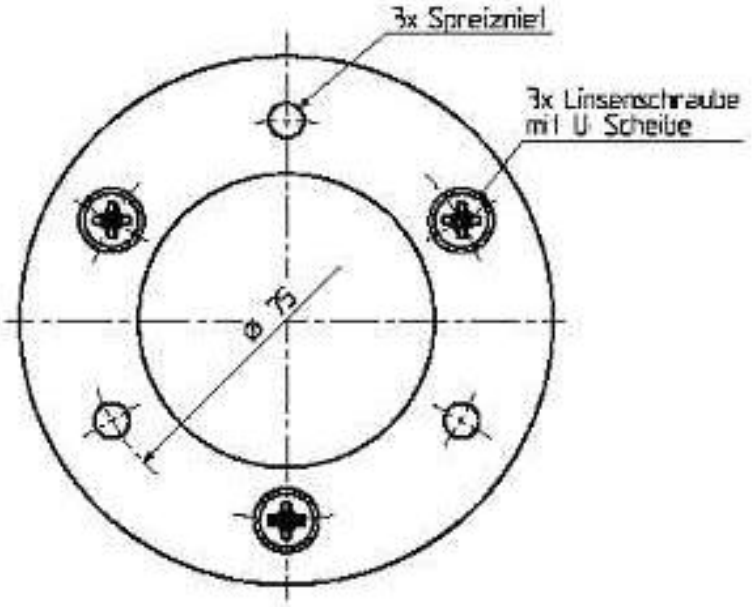
5.1.3.3 Omnidirectional Antenna, Part No. 10361, 4db





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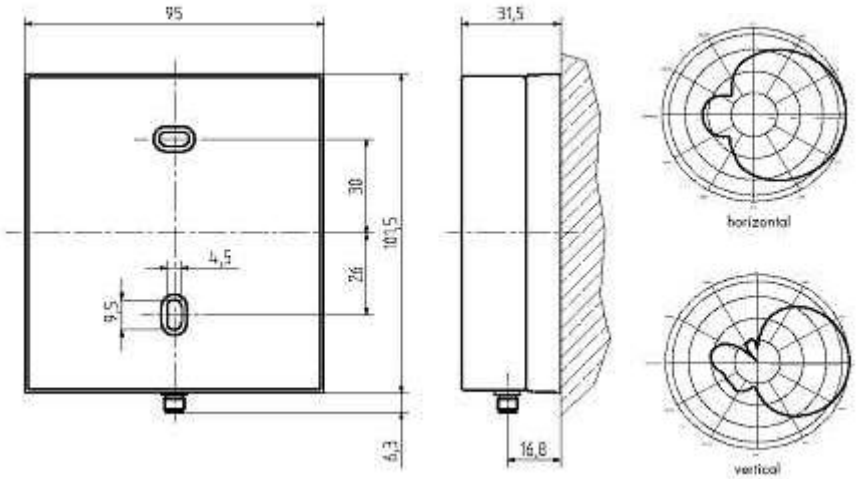
5.1.3.4 Directional Antenna, Part No. 10249 /10360/10368



Installation diagram and dissipation characteristics for part no. 10249 /10360/10368 antennas

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5.1.4 Antenna Combinations

The following combinations are practical:

- Two 10277 omnidirectional antennas;
- One 10277 omnidirectional antenna and one 9 db omnidirectional antenna for receiving;
- One 4dB directional antenna for transmitting and one 14 db omnidirectional antenna for receiving.

As a rule, mobile units are equipped with omnidirectional antennas. Directional antennas have an apex angle of approx. 30°. The advantage of directional antennas lies in their significantly lower price as well as the fact that reflecting and overlapping waves have less interfering influence.

5.1.5 Antenna Cables

Special antenna cables can be connected to the SMA ports. We can offer cables ranging in length from 0.5m to 4 m. In principle, longer cables can also be employed, however, the cable dampening at these high frequencies is so great that only about half the transmitting power is still available for antenna cables that are approx. 10m long. We always provide the correct adapters whenever antenna and cable sets are ordered together.

5.1.6 Antenna Splitters

We also offer antenna splitters which allow multiple antennas to be connected in parallel. Both 2- and 3-way splitters are available. The employment of antenna splitters may be practical if, for example, one antenna must be mounted outdoors and the other indoors. However, the use of splitters distributes the transmitting power across two antennas, leading to a corresponding decrease in range.

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5.2 Antennas for 448/459 MHz

5.2.1 Directional Antennas

For data transmissions over distances greater than 3km, we recommend the yagi antenna listed in Appendix 2.
This antenna is designed to be mounted on a mast. With an antenna gain of 6.2 dbi, line-of-sight ranges of up to 20km can be achieved. In urban areas, a range of 3km can be achieved, provided the antenna is mounted accordingly.

Description:	Directional yagi
Frequency:	440-475 MHz,
Impedance:	50 ohm
	6 dBi
Polarization:	Vertical/horizontal
Connector:	N-female/TNC-female
VSWR:	< 1.5
Radome:	UV resistant ABS,
	PU foam filling,
	RAL 7012
Radiator:	Copper
Passive elements:	Coated aluminum
Attachment:	Ø 35-60 mm, aluminum alloy bracket, stainless steel V-bolts and self-locking nuts
Lightning protection:	DC-short circuited
Temperature:	-35° - +80° C
IP:	67

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5.2.2 Omnidirectional Antennas

Where a wireless network is being established, the wireless master is generally equipped with an omnidirectional antenna.

Description:	Omnidirectional ground plane
Frequency:	446-454 MHz, 456-464 MHz,
Impedance:	50 ohm
Gain:	6 dBi
Polarization:	Vertical
Connector:	N-female/TNC-female
VSWR:	< 1.5
Radome:	UV resistant fibreglass,
	PU foam filling,
	White
Radiator:	Copper
Attachment:	Ø 35-60 mm, aluminum alloy bracket, stainless steel V-bolts and self-locking nuts
Lightning protection:	DC-short circuited, -grounded
Temperature:	-35° - +80° C
IP:	67

5.3 Antennas for 869MHz

Antenna gain: 0db
Height: 82mm
The antenna is mounted in an 18mm hole.
Connector: FME

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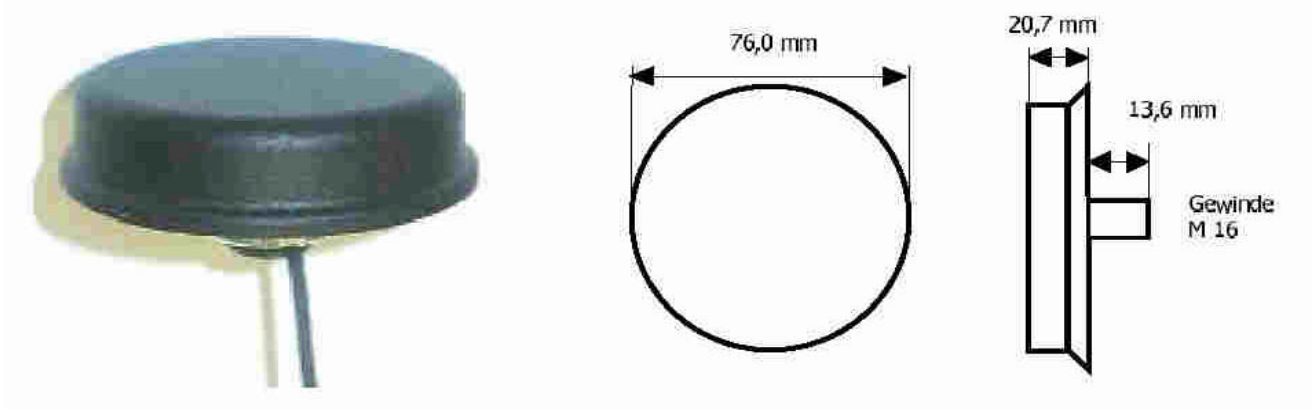
5.4 Antennas for GSM Cellular Telephones

View of a DATAEAGLE from the antenna connection side with SMA connectors
With the DE 2500/5500 GSM, the external antenna is connected to the SMA socket

GSM antenna, part no. 10549, waterproof roof mounting



This antenna comes with a 3m-long antenna cable and SMA adapters.

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5.5 Antennas for 1.9GHz DECT

The DATAEAGLE with DECT is equipped with two separate HF inputs and outputs and, therefore, with two SMA connectors. Each antenna can transmit and receive. The DE automatically switches to the better reception channel. Where the antennas are external, we therefore recommend mounting them 20 to 100cm apart. Antenna mounting is crucial for the quality of the data transmission to moving objects (e.g., cranes). We refer to the operation with two antennas as the DIVERSITY mode.

View of a DATAEAGLE from the antenna connection side with SMA connectors

Both omnidirectional and directional antennas are available for DECT. Antennas with a gain of up to 12db can be connected.

Antenna type	PN	Description	Application
DE_AN_19_12	10580	12db directional antenna	Outdoors
DE_AN_19_2	10410	Omnidirectional antenna, hole mounting 2.5 dB antenna gain	Outdoors, circuit cabinet, mobile component

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10410 antenna
DECT omnidirectional antenna

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5.6 Guidelines for Antenna Mounting

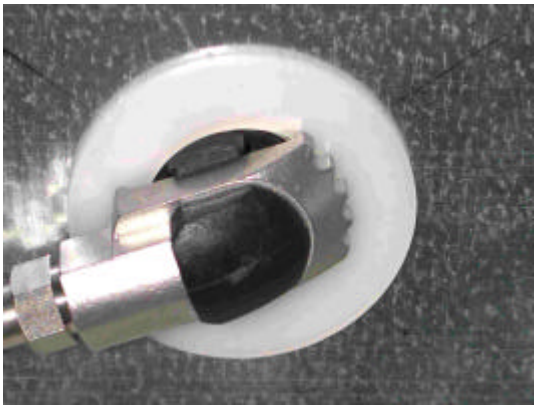
Basic principles for good antenna mounting

Always connect both antennas to the DATAEAGLE

- Distance between outdoor antennas: between 10 and 100cm
- If possible, mount the antennas of both DATAEAGLE at the same height;
- Align both antennas in the same direction, e.g., vertically;
- Maintain adequate distance to metal components and walls;
- Make sure antenna power can radiate freely;
- Mount antennas as far as possible from motors, frequency converters, or other sources of interference;
- We recommend line-of-sight installation for the best wireless connection. The best results are achieved if the DATAEAGLEs are mounted at an elevated and open location.

Installation in metal cabinet with hardware versions up to D1 (delivered by or before January, 2002)

Do not establish a ground connection through the antenna for 10277 omnidirectional antennas. This antenna must be insulated when mounted, otherwise ground loops through the power supply ground may arise. Use the insulation pads provided.



From hardware version D2 onwards (delivered after February, 2002) these antennas can be connected to the circuit cabinet ground (PE).

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6 Technical Specifications

6.1 Power Supply for All DATAEAGLEs

The power supply consists of a 24V DC input at the DATAEAGLE (9V DC to 33V DC). Optionally, an external 230 V AC mains power pack is also available. The 24V power supply can be connected directly to the circuit cabinet's 24V circuit.

PE must be connected to the circuit cabinet ground! If the PE connection is not made, the noise filter cannot filter out interference impulses on the 24V DC power supply line. In turn, this can result in malfunctions, errors, or even the destruction of the device. For more information on this point, please order our documentation, "EMI Measures in Industrial Environments".

6.1.1 Power Supply Pin Assignments

Terminal	Function
1	+9VDC to +33VDC
2	0V ground
3	PE circuit cabinet ground
4	Relay contact, output
5	Relay contact, output
6	24V DC circuit input

Connectors 4, 5, 6 are digital inputs/outputs for which parameters can be defined starting with software version 8. These connectors have no function prior to software version 8.

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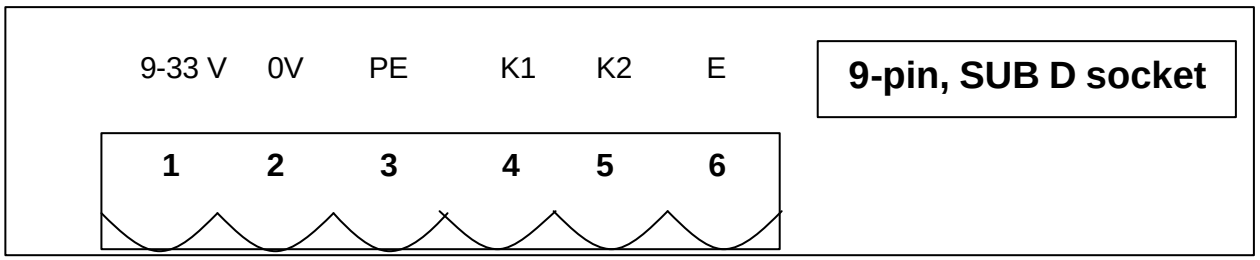
6.1.2 Device View from the Connector Side



Attention! The device is equipped with two of 9-pin Sub D sockets. Only the above socket is suitable for communications. The socket located on the antenna side is an AUX port for testing, diagnostics, and operating system updates.

Communications connector for Profibus, MPI, and serial connections

6.1.3 Supply Voltage Range

9 V DC to 33 V DC
Current consumption: 0.4A max., at 12V DC
0.2A at 24V DC
Input protection filter for 8kV bursts
Reverse-proof terminals
Self-resetting 1A fuse

6.1.4 Battery Operation

Autonomous operation for up to 8 hours is possible with the battery station (part no. 10246). A recharger (part no. 10280) is also available to recharge the battery pack.

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6.2 Serial Communications Port

6.2.1 DE 1000/2000/CP341 RS232/RS485 Pin Assignment, 9-pin Sub D Socket

SUB D pin	Function
1	20mA RX+
2	RS232 TXD
3	RS232 RXD
4	20mA TX+
5	GND
6	20mA TX-
7	CTS
8	RTS
9	20mA Rx-

6.2.2 DE 2000/3000/5000 MPI and Profibus Pin Assignment, 9-pin Sub D Socket

A 9-pin SubD socket is used on the MPI (DE2000/DE5000) and Profibus (DE2000, DE3000, DE3001). Pin assignments in the socket are as follows:

SUB D pin	Function
1	Not used
2	Not used
3	SE+ (RS485+)
4	Not used
5	Bus GND
6	Bus VCC
7	Not used
8	SE- (RS485-)
9	Not used

GND and VCC are galvanically isolated with respect to the DATAEAGLE power supply and are used for field bus termination.

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6.2.3 DE 1000 RS485

A 9-pin SubD socket is used for RS485 2- and 4-wire operation. Pin assignment in the socket is as follows:

SUB D pin	Function
1	Not used
2	Not used
3	SE+ (2-wire operation)
4	S+ (4-wire operation)
5	Bus GND
6	Bus VCC
7	Not used
8	SE- (2-wire operation)
9	S- (4-wire operation)

GND and VCC are galvanically isolated with respect to the DATAEAGLE power supply and are used for field bus termination.
The setting RTS=1 must be defined in the USER menu for the RS485 driver building block to be activated (TX enable)

6.2.4 DE 1000 RS422/RS485 Interface Termination

The final subscriber on the bus must be terminated with three resistors for RS422 and RS485.
These three resistors can be mounted on the cable plug.

6.2.5 DE 1000 Interface Parameters

Interface	Baud rate	Data bits	Parity	Stop bits
RS232	1200	8	N	1
RS422	2400	7	O	2
RS485	4800		E	
TTY/20mA	9600			
	19200			
	38400			
	57600			
	115200			

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6.2.6 Cable Connectors

A 9-pin SUB D socket is employed as the communications port.
This allows economical PC cables to be used for RS232 connections.

6.2.6.1 DE 1000 Cable - S5 PG Interface, Part No. 10375

Connection to a Siemens S5 is established via 20mA.

S5 PG interface		DATAEAGLE
15-pin SUBD connector		9-pin SUBD connector
Pin 2		Pin 4
Pin 5		Pin 6 and Pin 9
Pin 7		Pin 1
Bridge Pin 6 - 11 Bridge Pin 9 - 13		Bridge 3-8

6.2.6.2 DE 1000 Cable – PC, Part No. 10172

Connection is via the RS232 port.

PC COM port		DATAEAGLE
9-pin SUBD socket	Pin 2 1:1	9-pin SUBD connector
	Pin 3 1:1	Bridge 7-8
	Pin 5 1:1	Bridge 6-4-1

A 25 pin/9 pin gender changer is also required for the Siemens PG 740 programming device.

6.2.6.3 DE 1000 Cable – S7 Smartcable MPI Interface, Part No. 10172

Connection is via the RS232 port.

PC COM port		DATAEAGLE
9-pin SUBD socket		9-pin SUBD connector
	1:1 extension cable	

6.2.6.4 DE 2000/3000/5000 Cable – MPI/Profibus

Connection is via the RS485 port.

MPI Profibus		DATAEAGLE
9-pin SUBD socket		9-pin SUBD socket
Pin 3	SE+	Pin 3
Pin 8	SE-	Pin 8
		Pin 5 GND Pin 6 VCC

The cable MUST be a shielded Profibus cable.
VCC and GND are used as the Profibus termination.

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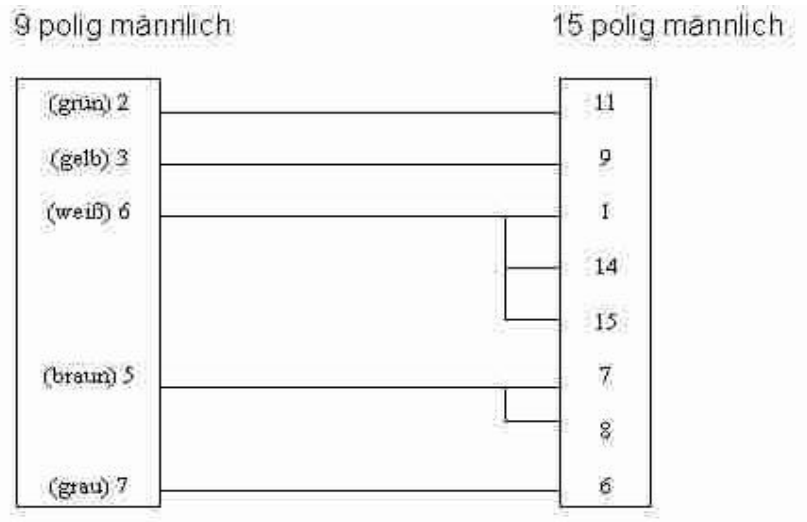
6.2.6.5 DE 1000 Cable Standard Delivery, Combination Pack, Part No. 10236

Different cables are required for controllers, depending on the particular application in question:

Cable 9 pin to 9 socket, 1:1 (PC side)	Part no. 10172
Cable 9 pin to 9 socket, 1:1 (PLC side)	Part no. 10172
25-to-9-pin adapter to 9 pin for PG 740	Part no. 10411
S5 AS511 cable – DE 1000 (PLC side)	Part no. 10375

6.2.6.6 DE2400 Cable – TCU + Satel Modem



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6.3 AUX Port

There is also a 9-pin SUBD socket located on the antenna side. This port is suitable for external wireless systems with the DE 2400 as well as for diagnostics. Please use only appropriate cables and test equipment in conjunction with this port. It is not intended for use by general users. Connecting the wrong cables can result in the destruction of the device.

DEMon diagnostic software is available for commissioning. This can log wireless traffic at resolutions down to one second and save the results to a PC hard drive. The outstanding feature of this software, however, is the continuous display of the transmission quality for each subscriber, the number of data packets per second, and the duration of a wireless interruption if the wireless connection goes down.

6.4 I/O Interface

Aside from the power supply, a 24V DC input as well as a relay output are also included on the 6-pin Phoenix connector. Starting with software version 9.2, the function of this I/O interface can be defined. (Please contact us with regard to availability).

The following functions are implemented:

- I/O transmission (E-Stop function);
- I/O mapping to PLC;
- Wireless connection signaling;
- Customer-/user-specific function

During I/O transmission, the digital input is mapped to the output of the partner DATAEAGLE. This allows a digital signal to be transmitted as well as the serial controller connection. If the input is permanently fixed at 24V DC, it can also be employed as a signal that a wireless connection exists.

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6.5 Overview of Siemens PLC Connections

The following table illustrates possible connections to SIEMENS controllers.

- SIEMENS S5 via AS511 PG interface
- SIEMENS S7-200 via PC-PPI cable (PC adapter) 6ES7 972-0CA21-0XA0
- SIEMENS S7-300/400 via PC-MPI cable (PC adapter) 6ES7972-0CA22-0XA0
- Other controllers available on request.

Controller	Interface	Software protocol	Parameters	Physical layer	DATAEAGLE© support
S5	PG	AS511	9600 8E1	TTY / 20mA	Yes - DE1000
S5	PG	L1	9600 8E1	TTY / 20mA	Yes - DE1000
S5	Profibus DP	Profibus DP	9660-12 MB	RS485 2-wire	Yes – DE3000
S7 200	PPI	Open ASCII	9600 8E1	RS485 2-wire	Yes - DE1000
S7 200	PPI	Siemens	9600 8E1	RS485 2-wire	Yes - DE1000
S7 200	PPI smart cable	Siemens	9600 8E1	RS232	Yes - DE1000
S7 300 und 400	MPI	Transparent	187kBit	RS485	Yes - DE 5000
S7 300 und 400	MPI	PG function	187kBit	RS485	Yes – DE1000[14]
S7 300 und 400	MPI	Read/write data building block	187kBit	RS485	Yes - DE2000
S7 300 und 400	Profibus DP slave	PROFIBUS DP	9600 - 12 MB	RS485 2-wire	Yes - DE2000 + DE 3000[15] DE 3001

6.6 Temperature Range

Operating temperature	-10°C to +60°C
Storage temperature	-30°C to +85°C
Expanded temperature range	-25°C to +60°C optionally available

If the operating temperature range drops below –10°, the display is no longer readable. If a maximum temperature of 75°C is exceeded, the foil may separate from the keypad body. The device electronics operate from–20° to + 80°C.

[14] With external MPI adapter

[15] DE 2000 in the file drawer mode– DE 3000 as a remote DP slave

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6.7 Wireless Transmission

DE1000, DE2000, DE3000
2.4GHz ISM band, digital transmission, 58 possible channel settings
Direct Sequence Spread Spectrum
Transmitting power: 100mW (20dbm)
3 completely separate transmissions are possible. Additional, parallel wireless transmission paths reduce the transfer rate.
Data transmission speed per wireless channel: Up to 1 MB per second
Requires no licensing in Europe.
This band is available for ISM applications throughout the world. However, there may be additional, national or local licensing requirements. Please determine whether such requirements exist in your area before ordering.

DE1100, DE2100,DE3100, DE4100
1.9 GHz DECT Band
Standardized and certified transmission technique employing frequency hopping
Transmitting power: Up to 250mW
Employment of gain antennas up to 12db is permitted.
Requires no licensing in Europe. Not available in the US, Canada, and Japan as these bands have already been assigned for other purposes.

DE1300 DE2300, DE 3300
869 MHz license-free, 500mW transmitting power
Gain antennas not permitted, stipulated cycle/pause ratio
Data transmission speed per wireless channel: Up to 19,200 bits per second

DE2400, DE3400
448MHz, license required, can be used only in Germany, using the time-slot procedure (6 seconds per minute)
Transmitting power: 6W
Data transmission speed per wireless channel: Up to 19,200 bits per second
Antennas with antenna gain explicitly required

DE2410
459MHz, license required (continuous, but maximum data volume stipulated)
Transmitting power: 6W
Data transmission speed per wireless channel: Up to 19,200 bits per second
Omnidirectional antennas with antenna gain not permitted, but directional antennas are allowed

DE DE2500, DE3500
GSM 900MHz, license required
Transmitting power: 2W
Data transmission speed per wireless channel: Up to 9,600 bits per second

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6.8 Ranges

6.8.1 DE 1000, DE 2000, DE 3000 Ranges on the 2.4GHz ISM Band

Legislation has restricted the maximum transmitting power to 100mW. The indicated ranges are merely reference values and may vary depending on ambient conditions such as steel, concrete, temperature, weather, etc. In line-of-sight tests facing a vineyard slope, we were able to reach a range of 3.8km. The Diversity Mode permits the receive channel (antenna 2) to be equipped with antennas with unlimited antenna gain. The indicated ranges are conservative values that have been successfully tested for years in 90% of the application. In contrast to range values given by Office WLAN systems providers, the values indicated here are based on practical applications. Office WLAN 802.11 transmits predominantly at 30mW and a high data rate. Compared with this system, our area coverage is approx. three times greater.

In buildings, across floors or through walls	Up to 30 m linear distance
Halls	Up to 300m
Line-of-sight links	1km –3km
Diversity mode with 14db directional receiving antennas	Up to 4 km for line-of-sight links

6.8.2 DE 2100, DECT 1.9 GHz Band Ranges

Despite a higher transmitting power of 250mW, we do not specify greater ranges when compared to 2.4GHz. However, DECT does provide better area coverage in industrial halls. Thanks to gain antennas, transmitting power equivalent to approx. 700mW can be attained. We have practical experience in large industrial halls measuring 300 x 300m and a single wireless cell.

6.8.3 DE 2300 Ranges on the 869 MHz Band

869MHz with 500mW covers the intermediate area between 2.4GHz / DECT and bands that require a license within a range around 1km. However, a cycle/pause ratio is stipulated. A setting at the DATAEAGLE allows the data exchange rhythm to be adjusted to comply with the relevant licensing requirements.

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6.9 Licenses

6.9.1 2.4GHz ISM Band

Germany	Registration number: G133467J Codes BAPT 222ZV126, June, 97 Applied: ETS 300 328, Feb. 96
Switzerland	Registration number: BAKOM 99.0100.L.P
Austria	GZ100 853-ZB/99 in accord. with ERC/DEC(97)10
Holland	NL99072773 Code RO167SRD3a
Belgium	CE 0125 (!)
Luxemburg	ILT 090800/217
USA	Some of our units are available with wireless modules approved for use in the US.

Since 04/08/2000, the EG requires approval in accordance with the new guideline, 1999/5/EG. This represents an additional, significant simplification. The following identifier is applied to indicate compliance: CE 0125(!)

6.9.2 1.9 GHz DECT

Within EUROPE, there is a requirement for the general approval of the wireless module manufacturer. Outside Europe, these devices may not be employed as these bands have already been assigned for other purposes (general cellular telephone traffic).

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6.10 Data Security

The topic of data security represents a crucial perspective. This topic is discussed below from the following standpoints:

- Data security at the hardware interface;
- Transmission checks by the controller;
- Data security on the wireless side.

6.10.1 Transmission Security, Hardware Interface

Protocols are employed at the hardware interface in accordance with the standards and interface definitions. SIEMENS S7 MPI and PROFIBUS DP have sophisticated security and error recognition procedures, SIEMENS S5 L1 employs a simple checksum function.

6.10.2 Transmission Checks by the Controller

From a PLC program standpoint, a check can be simply implemented by employing a utility data word as a control flag. Here, using the order counter that is incremented at every utility data change and reflected back by the slave, a determination can be made as to whether or not the most recent utility data arrived. In any case, the application program must be able to recognize a temporary or continuous loss of the wireless connection, and this must be intercepted accordingly.

6.10.3 Transmission Security on the Wireless Side

6.10.3.1 2.4GHz

On the wireless side, the object in question is an encrypted digital signal that operates in the so-called “Direct Sequence Spread Spectrum” process. The data are transmitted together with the general frequency noise. The software protocol itself complies with IEC 802.11 from the WLAN Office area. However, in contrast to the latter, an optimized Barker code is utilized. Hackers cannot therefore employ WLAN tools for reception, manipulation, and to produce interference.

An own software protocol with checksum calculation ensures that there can be no unnoticed data manipulation. The technical expenses required to eavesdrop or manipulate the wireless transmission are quite large and comparable with DECT and GSM transmission technologies. Interferences on the wireless side are safely detected by CRC checksum calculations, and the software prevents such interference from being interpreted as valid data.

6.10.3.2 1.9GHz DECT

DECT represents a standard from the telephone industry, both on the wireless side by frequency hopping, as well as its own security layer at the wireless level. Thus, for example, DECT has 128bit encryption whose keys are dynamically changed in one-second cycles.

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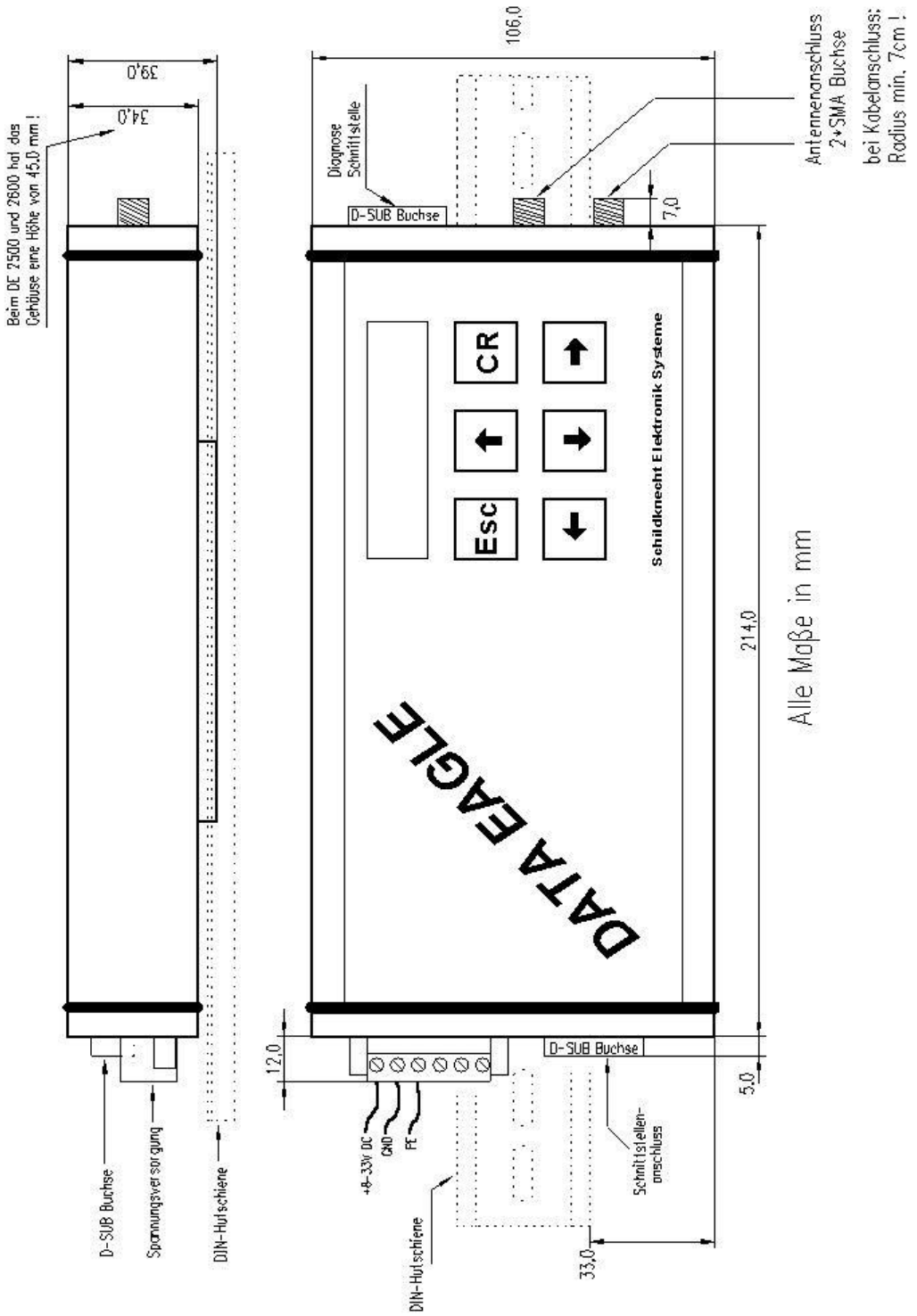
6.11 Radome Dimensions and Weights

ALU IP 54 230 x 105 x 30 mm
Weight, without antenna: 700g
Please also refer to Wireless Modem Installation Options



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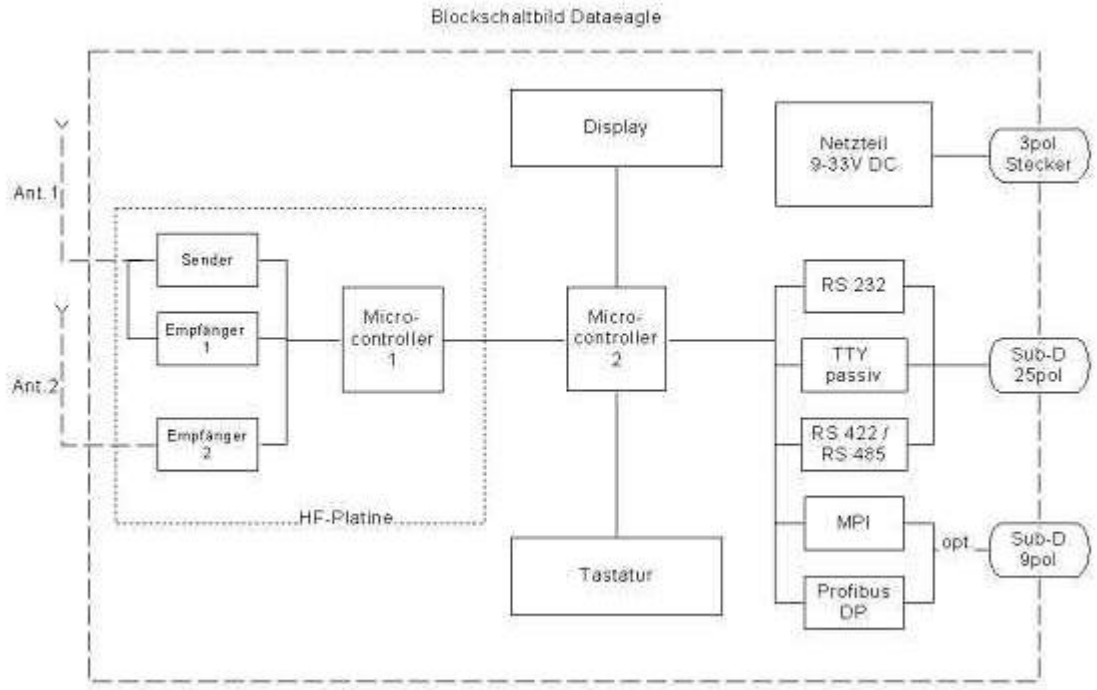
6.12 DATAEAGLE Block Circuit Diagram



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7 Product Limitations

7.1 Known Negative Effects

The 2.4GHz and 1.9GHz wideband wireless systems employed are ideally suited to industrial applications. However, since radio waves are a ”shared medium”, short-term transmission bottlenecks cannot be entirely ruled out. As a user, you will notice these, for example, in the form of a short dead time as circumstances change. In the DE3000 Profibus family, the connected Profibus subscribers have their own life and monitor the connection themselves. Therefore it cannot be ruled out that a 100 ms interruption on the wireless side results in a bus error being detected at the Profibus master. As a rule, the controller resets, this type of error after approx. 2 seconds. Customers have experienced this effect, sometimes once a day, once a week, once a month, or once a year. During the project planning phase it is crucial that the types of influences that can result in a Profibus interruption be determined. As an alternative, our DE 2000 system is significantly more resistant to short-term wireless interruptions because the controllers here do not perform their own monitoring.

7.2 Influence from Other Wireless Systems

7.2.1 DATAEAGLE with 2.4GHz Wireless Systems

DATAEAGLE has been tested for compliance with CE conformity. Other wireless systems on other bands (e.g., 900 &1800 MHz cellular telephones, 1.9GHz DECT, 433MHz, 869MHz, remote crane controllers) are neither interfered with, nor do they themselves interfere with the DATAEAGLE wireless modules. Nonetheless we recommend generous spatial distances between the antennas if several wireless systems are being operated in parallel.

A special situation arises when wireless systems transmit on the same frequency band. 2.4GHz is a free band, open to other subscribers as well. The employment of Sequence Spread Spectrum (DSSS) technology transmits the utility signal in the noise by spreading its spectrum. This makes the system extremely impervious to interferences. Technically simple systems such as baby monitors do not employ this technology. Practical tests have shown that the transmission quality of the DATAEAGLE can drop by 2-5% in cases where a baby monitor is located in the immediate vicinity and is transmitting on exactly the same channel. In the worst cases, this is reflected by a transmission time that is longer by a corresponding percentage. This conflict can, however, be avoided by simply changing the wireless channel.

Both the ”Bluetooth” transmission standard as well as Wireless LAN transmit at 2.4GHz. Bluetooth utilizes the frequency hopping procedure. Here too, however, only a minimum influence with regard to the DATAEAGLE should be anticipated in the form of reduced data throughput and, consequently, increased transmission time. DATAEAGLE increases background noise for these systems. This may result in a decrease in the range of Bluetooth systems. WLAN in accordance with 802.11b also utilizes DSSS for transmission. In all, three totally separate transmission ranges are possible on the 2.4GHz band. If, for example, WLAN is also used in a factory hall, evasion to DECT may be practical, or simply setting the DATAEAGLE to a different channel.

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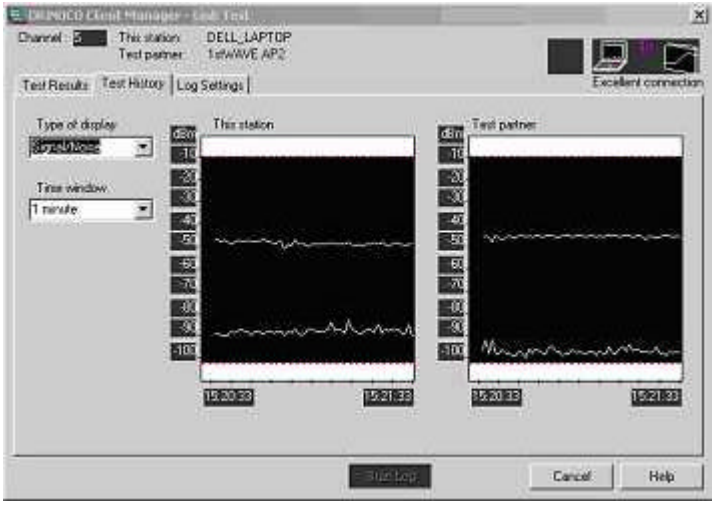
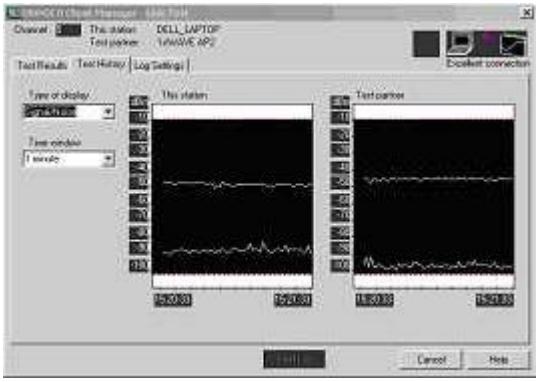
7.2.1.1 Interference Test with the Wireless LAN System

An interference test was performed with a Wireless LAN (IEE 802.11a) test setup.
The interference behavior of a DATAEAGLE wireless transmission path as well as the influence of DATAEAGLE on WLAN were both examined.

The figure on the left illustrates the signal-to-noise ratio of the WLAN path without interference. As the figure on the right illustrates, DATAEAGLE results in a slight reduction of the signal-to-noise ratio. Still operating at 100% quality, the DATAEAGLE wireless transmission path shows no measurable influence by WLL.



Interference-free WLL path


DATAEAGLE transmitting in the same frequency range

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7.2.1.2 Bluetooth

Bluetooth is a frequency hopping system, acting as a narrow band interference source that is suppressed by the DSSS procedure used and thus resulting in only a minimum interference effect in the form of a minor utility interference signal. In contrast, if the DATAEAGLE utilizes the 22MHz channel bandwidth, Bluetooth will slow down by approx. 33%.

7.2.2 DATAEAGLE with DECT 1.9GHz

The DECT standard was developed with the specific goal of permitting multiple, independent wireless transmission paths to operate in parallel. Only DECT-compatible systems may transmit on this band. DECT employs a frequency/time multiplex procedure, meaning that there are 128 transmit and receive channels available.

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7.3 Parallel Operation of Multiple Wireless Transmission Paths in a Single Wireless Cell

7.3.1 ISM 2.4GHz

Up to four independent wireless transmission paths can be operated in parallel within a spatial arrangement without any of them influencing each other. First, all DATAEAGLEs must be given an individual wireless address. After this, the wireless channels are set up for each path in the range from 1-59. Even if several wireless transmission paths are operating on a single wireless channel, only the reaction time will increase in a manner similar to the collision behavior with Ethernet cable links. We recommend a channel difference of more than 20 between two wireless transmission paths, e.g., channel 1 and channel 21. For technical reasons, crosstalk will occur between neighboring channels, e.g., channels 1 and 2, but, thanks to device addressing, this will not result in false interpretation on the other wireless transmission path.

Applications with up to seven wireless transmission paths (DE 3001) in a single wireless cell have already been implemented. Depending on the type of DATAEAGLE employed, this can, however, result in undesired effects. Particularly the DE 3001 Profibus series and DE5000-MPI have connected subscribers and applications for which time is often critical. In such cases, we recommend limiting parallel connections to four.

7.3.2 DECT 1.9GHz

With DECT, up to 128 independent wireless transmission paths can theoretically be operated in parallel within a common wireless cell. Positive practical experiences have, so far, only been made with a maximum of 44 wireless transmission paths.

7.4 Availability of the Wireless Connection

During the planning phase for a free frequency band such as ISM 869MHz, 2.4GHz, and DECT 1.9GHz it must always be assumed that interference will make connections between wireless systems impossible for short periods of time. For the DE2000 this is generally less critical for applications than for the DE3000.

Brief system interruptions of 1-2 seconds are also possible. This is comparable to a “busy signal” in the telephone system. Always design your application so that these types of problems will be tolerated. In practice, these types of interruptions occur between once per day and once per month. Because up to 20 data transmissions can take place every second, this represents an availability of >99,9%.

As of hardware revision D and software revision 8.3 for DE2000, DE2400, DE3000, DE3001, the availability of the wireless transmission path can be checked with out Windows PC DE-Mon software.

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7.5 Electronic Smog

Currently, an intense discussion is underway concerning the effect of cellular telephone radiation on human tissue. Very contrary arguments are advanced in regard to this topic. Unfortunately it is hardly possible to objectively discuss this topic and evaluate the risks critically.

The discussion focuses in particular on cellular telephone transmitters in urban areas that transmit at up to 50 Watts. DATAEAGLE, on the other hand, transmits at 0.1 Watt. A cell phone transmits with a maximum of up to 2 Watts which, in addition, generally act directly on the body (the ear). Based on the current level of knowledge, the electronic smog exposure caused by DATAEAGLE can be disregarded when compared with that of cellular telephone systems and other transmitting systems such as TV, radio, and ham radio. For example, at a trade fair, relatively extreme exposure can be anticipated from a surface area of 500 x 500m and 10,000 visitors, each with a cell phone. From a distance of approx. 5 meters it is already very difficult to measure the HF energy with a sensitive spectrum analyzer.

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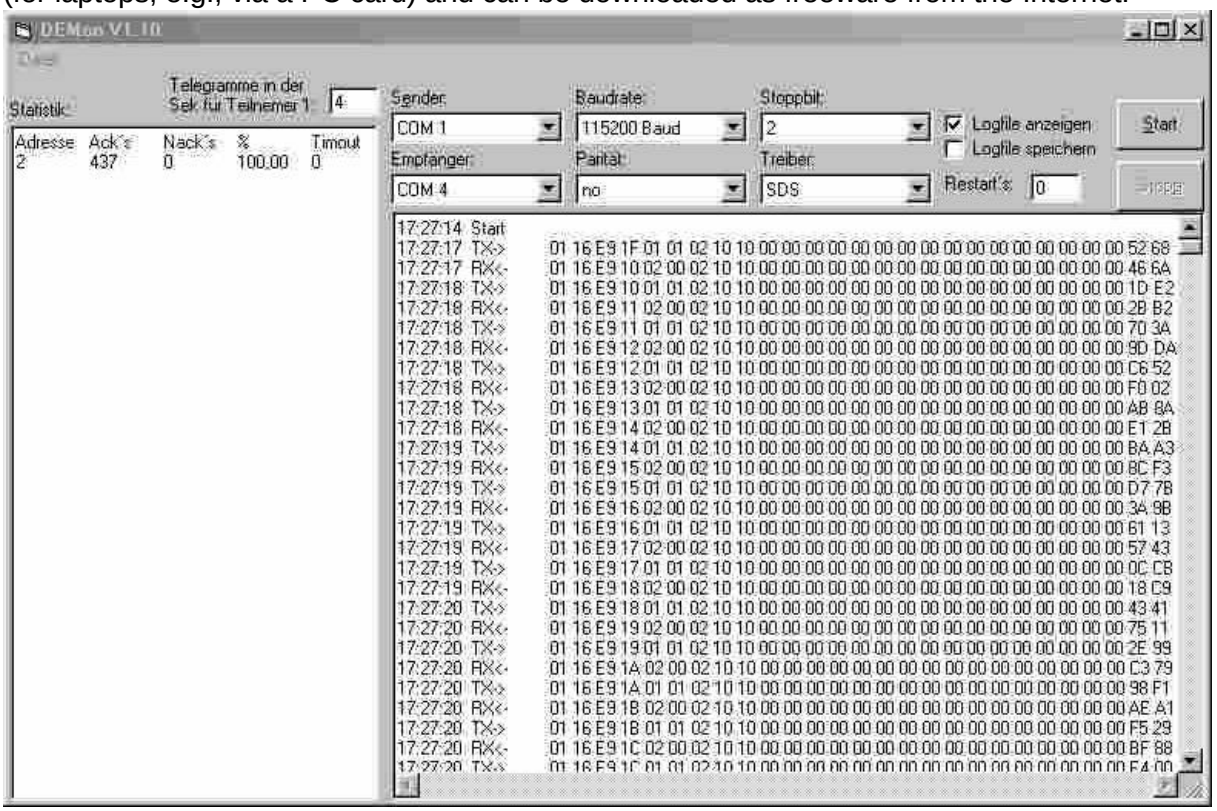
8 DEMon Diagnostic Software

Starting with hardware revision D1, a Windows 95/98/NT4 diagnostic software can be connected to the AUX port to display and save the data traffic on the wireless transmission path. Long-term measurements thus allow qualitative statements regarding the wireless connection, the number of transmission attempts, etc. to be made. DEMon requires two serial ports (for laptops, e.g., via a PC card) and can be downloaded as freeware from the Internet.



The window on the left displays the summarized statistics, in this case, for slave address 2. 437 transmissions have taken place without errors (NACK =0). The Timeout window displays the time (in seconds) of the longest wireless transmission path interruption. In the network mode, all activated slaves are shown here. A special cable is used because two serial ports are required for diagnostics. Connection is always to the DATAEAGLE master. In a separate window, the wireless connection can be logged and time-stamped for freely definable intervals, down to the seconds range.

The transmission quality can be saved as a log file at definable intervals (1 second to 1 hour).

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9 Terminology Used and Index

AG (automation device)	Programmable memory controller, e.g., SIEMENS S5 and S7
DE	Abbreviation used for the DATAEAGLE
DE Remote	Abbreviation used for the partner DATAEAGLE
Diversity	With antenna diversity, two antennas are used for each DATAEAGLE.
Wireless channel	The ISM band allows 58 different channels to be used, on which transmissions can be made independent of one another.
Master side	In the DE 3000 system, the DE directly connected to the Profibus master via the Profibus line is referred to as the DE master side.
MPI	MPI is the designation for the programming device interface on the SIEMENS S7 300 and 400 series of controllers.
MPI station address	Each subscriber at an MPI bus has a number. As the MPI partner address, the DATAEAGLE requires the address of the controller. The MPI station address is the MPI's own address.
Wireless partner address	The partner address is the wireless address of a DATAEAGLE to which a connection is to be established.
PG (programming device)	As a rule, a PC or laptop connected to the AG via its serial port.
File drawer operation	Describes the mode used by the DATAEAGLE DE 2000 series for controller connection, field bus operation , or I/O module connection via integrated protocols. For this, the data are exchanged in transmit and receive drawers.
PROFIBUS DP	DE 2000 devices are available with a PROFIBUS DP slave module. The DE 3000 system allows a PROFIBUS slave to be connected to a master via wireless transmission.
Slave side	In the DE 3000 system, the DE directly connected to the Profibus slave via the Profibus line is referred to as the DE slave side.
Wireless station address	The station address is the address of the wireless modem at which it can be addressed. This address is a software address and is only relevant within a wireless channel. Up to 99 DATAEAGLEs can operate on the same wireless channel (not practical in actual applications).

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Target	DE 3000 can connect any desired Profibus slave subscriber to a master via a wireless link. The actual slave is referred to as the target .
TCU	Time Control Unit: The real-time device used for DE2400 timeslot techniques.
Transparent mode	DE 1000 operating mode: Virtual cable. Various settings for the serial interface can be defined in the DATAEAGLE.
Timeslot technique	Timeslot techniques used on the non-public 448 MHz band. For this, the RegTP stipulates that transmission may not be continuous, but exclusive transmission is instead limited to only six seconds in every minute.
WLAN	Wireless LAN in accordance with IEC 802.11
AG	Controller/working unit
DW	Data word
DB	Data byte
PLC	Programmable Logic Controller
DZ	Data timeslot
RegTP	Regulatory authority which assigns frequencies in Germany.
DP	Profibus

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Documentation history

Version	Revision	Editor	Date
V 1.0	Initial version	Sch	07, 1998
V 2.0	Menu tree	Sch	11, 1998
V 2, 1	Table of contents /WINeagle	Sch	06, 1999
V 2.3	Menu, wireless network operation	Ro	07, 1999
V 2.4	Expansion, wireless network operation	Sch	07, 1999
V 2.5	File drawer operation	Sch	09, 1999
V 2.6	Antenna pictures	Sch	10, 1999
V 2.7	Wireless network, document structure	Sch	03, 2000
V 3.0	File drawer S5, S7, I/O	Sch	04, 2000
V 3, 1	Wireless polling rate, antenna dimension drawing, WinE Device options	Sch	07, 2000
V 3, 2	Appendix, DE 3000	Sch	07, 2000
V 3.4	Doc. structure conversion	Sch	10, 2000
V 3.5	Doc. structure and typeface conversion	Sa	10, 2000
V 3.6	Menu structure menu tree, commissioning	Sa	12, 2000
V 3.9	DE 3001, commissioning	Sa/Sch	12, 2000
V 4.0	Wiring diagram, DE2000 timing calculation	Sch	03, 2001
V 4, 1	Hardware revision D, DE2600	Sch	07, 2001
V 4.3	DE3001/93, 75; DE2001; antenna mounting	Sch	10, 2001
V 4.4	DE4000/DE5000, availability, DEMon	Sch	02, 2002
V 4.6	DE 2100/5500, commissioning, indexed pictures	Sch	06, 2003
V 4.7	Menu for all devices	Sch	08, 2003
V 5.1	DECT, GSM, antennas,	Sch,OH	04, 2004

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